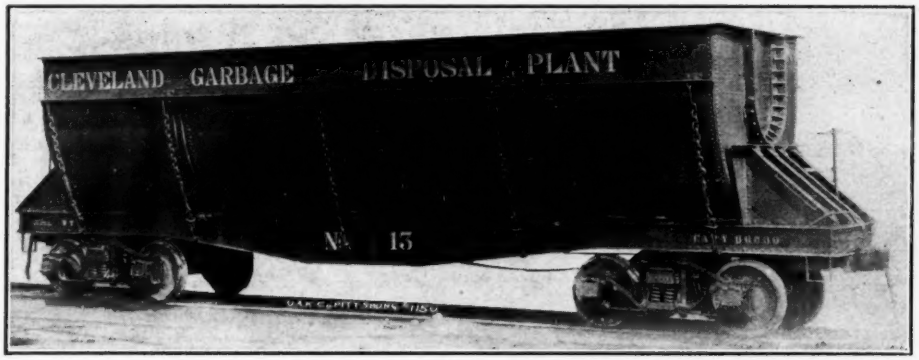
MUNICIPAL ENGINEERING

The World's Leading Municipal Publication.



CAR FOR TRANSPORTING GARBAGE FROM THE CITY LOADING STATION TO CLEVELAND'S MUNICIPAL GARBAGE REDUCTION PLANT.

Vol. XLVII. SEPTEMBER, 1914. No. 3.

"If one has but five minutes in which to perform a task, three minutes should be consumed in ascertaining how to do it."

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STREET CLEANING
METHODS AND RESULTS

By Edward D. Very, Sanitary Engineer, Battery Place, New York City.

Experience for a number of years in the street cleaning departments of New York fits the author to discuss his subject in a manner to attract the attention of the many city officials who are intensely interested in it and who are looking for some one who can be depended upon to give valuable and unbiased advice and information He will follow this article with others upon particular parts of the subject if inquiries for further or more detailed discussion are received. The pictures are selected by the editor to illustrate the development sketched by the author and the types of machines mentioned, some of them being reproduced from earlier volumes of MUNICIPAL ENGINEERING.

THE items considered in choice of pavement are: first cost, ease of traction, non-slipperiness, ease of cleaning, noiselessness, dustlessness and sanitariness.

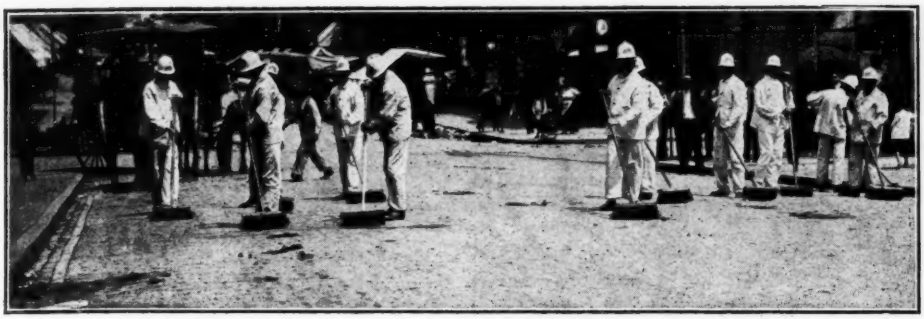
Only very recently have ease of cleaning and sanitariness been included in these items. Tillson gives these items a value of 15 and 13, respectively, out of a total of 100 points. He then lists the pavements in order of their value as follows: For ease of cleaning, brick 15, asphalt, wood and bitulithic 14, and granite 10: For sanitariness, wood 13, asphalt and bitulithic 12, brick 10 and granite 9. Most men engaged in street cleaning will disagree with these values as regards wood pavements, as they are very hard to clean thoroly.

There are two adverse interests in a practical choice; the users who want pavement conducive to ease of traction, and the residents and pedestrians who want quiet and freedom from dust.

There are two general classes of street dirt, the natural and therefore unavoidable and that due to carelessness and therefore avoidable. In the first class are included soot and dust from the air, detritus from the wear of the pavements, vehicle tires and horses' shoes, excrement of animals, dirt and sand which works up thru the joints of pavements laid on earth or sand foundations and having sand or gravel joints, dirt brought in from adjacent dirt or macadam streets, and leaves from shade trees. In the second class are refuse swept from buildings and sidewalks, refuse thrown from buildings, refuse discarded by those using them, dirt dropped from overloaded or leaking vehicles, and debris from construction operations.

The removal of materials of the first class is the real duty of the street cleaner and his studies ought to be confined to the proper performance of that duty. The removal of the materials of the second class ought not to be necessary, but, even in the face of the existence of ordinances covering the prevention of every detail, the nuisance exists in every city and to a very large extent. The duty of prevention is really that of the police and health authorities.

In New York City careless littering is estimated to cause a loss of time on the part of the sweeper of about 20 per cent. in the Boro of Manhattan and of 10 per cent. in the other Boros. Dr. Cronin says "a campaign of education should be instituted in the body politic to the end that they would understand that they are individually responsible that the cleanliness



THE MAN WITH THE BROOM *is the primitive type of street sweeper. This is a gang of white wings in Philadelphia.*

of the streets be maintained, and they as individuals will do nothing that will contribute to the disorder of the street, and where possible, prevent others from doing anything disorderly."

Some attempt has been made to formulate an estimate of the amount of materials which naturally accumulate upon a city street, but such an attempt is bound to fail, as the contributing elements vary in different localities in a city and in different cities. Where figures are given they do not really present any valuable data to the student. It is estimated that six tons of soot and dust fall upon a square mile of city during one month of winter. Again we are told that 1,000 horses will excrete 500 gallons of urine and 10 tons of dung during a working day of 8 hours. These figures may interest the student in the abstract but have no real value to the practical operator.

The only method of arriving at quantities is a study of the exact conditions on the spot and a continued study of the conditions as they change. The first study should be made by an expert, the other will naturally become a part of the duty of the supervisor of the work when in operation.

Most writers on street cleaning and street dust, lay emphasis upon the necessity of cleansing almost wholly upon the ground of the menace to health which lurks in street filth. Sanitarians vary widely on this point.

Dr. Soper says: "There is something incongruous about a board of health conducting a crusade against smoke and noise and at the same time allowing the streets to be filthy with dust and dirt." Prof. Gorham says: "The very processes which tend to produce dust are the very processes which destroy bacteria."

Dr. Hayes says: "The micro-organisms which appear in street dust are the bacilli of tuberculosis, many varieties of the colon bacilli, the bacillus aerogenes capsulatus, and the bacilli of tetanus, glanders, diptheria, anthrox, malignant edema, typhoid fever and epidemic dysentary. Dr. Soper says: "Most of the bacteria are probably of harmless saprophytic species."

Dr. Cronin says: "With perfect cleanliness sanitary science would be a lost art. Flies, mosquitoes, germs and bugs, all would be out of a job, and what a calamity to think of the numberless societies that would cease to exist."

The real reason, however, for cleaning streets should be the desire to be clean because of the great degree of comfort which is induced by cleanly conditions. One may do without a daily bath and still be fairly healthy, but one then loses the exhilaration and feeling of general well being and comfort experienced by the daily bather.

Streets in large cities today, besides being used as arteries for commercial traffic, have become the play grounds of the people. From the wealthy owner of the high-powered joy-car to the child of the tenement district playing his game, the street is the theatre of recreation. The automobile with its low body and quick movement is responsible for the extraordinary movement of dust and the infant

THIS STREET SWEEPER, *also in Philadelphia, has the full outfit necessary for the best and quickest work.*

in the baby carriage is the worst sufferer from its effects.

The items to be considered in a street cleaning system are: kind of pavement, condition of the pavement, amount and nature of traffic, street railway tracks, character of the neighborhood and character of the people in the neighborhood. Each has a distinct value and no formula can be presented, with so many values to be obtained, which will be easy of solution.

The elementary method of cleaning is the man with the broom. Not only must he be equipped with a push broom, but with a pan scraper, a squeegee, a shovel, cans and a can carrier; to which should be added a sprinkling can.

The broom is usually one which has a 4x18-inch block filled with split bamboo, rattan, hickory, steel wire or black African bass. The block usually is fitted with a steel scraper.

The pan scraper is constructed like a dust pan with turned up sides and back. It is about 38 inches wide by 15 inches deep.

The squeegee is a board about 30 inches wide, fitted with a rubber strip which extends below the lower edge of the board. Brooms, pan scrapers and squeegees have handles about 66 inches long.

The cans are made to hold about 3 cubic feet of dirt and taper from 19 inches in diameter at the top to 17 inches at the bottom, so that they may be nested for ease of carriage. The can carrier has two large wheels and two small, and has a platform upon which the can rests and a handle for propulsion.

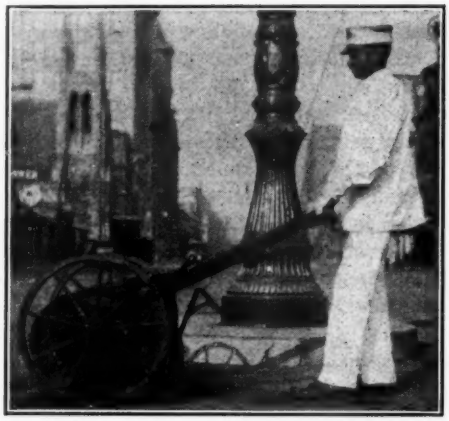
This method of cleaning is fairly effective but is a dust raiser, and the ability of the man to cover areas is very limited, especially at the present time, when the automobile has come into such general use that there is a constant parade which interferes with the sweeper in his work.

Many find fault with the broom because of the dust it raises, but there are hand machine brooms built on the principle of the carpet sweeper which are not dust raisers and which, as a matter of fact do much more effective work.

The pan scraper is only valuable to remove manure, mud and coarse litter and its use should be limited to the time necessary for such work and the broom used for dust removal.

A new can carrier has just been devised which carries two cans and is so balanced that the two cans are more easily manipulated than the one at present. This improvement is of considerable

THIS PHILADELPHIA WHITE WING *has the hand-machine sweeper mentioned by the author.*



AN EARLY STREET SWEEPING OUTFIT. *One broom to loosen the dirt and another to sweep it into windrows. No provision for preventing dust.*

value and will appeal to the street cleaning official as a great step ahead.

The area a sweeper can keep clean, of course, depends upon the existence of the adverse conditions named above. Waring tried a test in New York City, for one week, and found that the area one sweeper was able to keep clean, in a day of 8 hours, varied from 2,212 square yards to 15,075 square yards, with an average over the whole city of 5,745 square yards.

The efficiency division of the Civil Service Commission of Chicago in 1912 published a report which says: "From an analysis of the findings of time and motion studies of street cleaners, the following table has been deduced, upon which are based a relative difficulty of cleaning different pavements under varying conditions, and the standards and equivalent areas to be cleaned by one man in one eight-hour day:

Pavement.	Condition of Pavement.	Sq. Yards.
Asphalt	Good	21,500
Asphalt	Fair	19,300
Asphalt	Bad	17,200
Creosote Block	Good	21,500
Brick	Good	16,000
Brick	Fair	14,400
Brick	Poor	12,800
Granite	Good	13,400
Granite	Fair	12,100
Grainte	Poor	10,700

I submit the figures without subscrib-

A MACHINE BROOM OUTFIT *with sprinkler and enough brooms to cover one-half the street.*

HAND BROOMS *in the gutter follow the gang of machine brooms.*

ing to them. There appears to be what Emerson calls "great discrepancy between actual results and reasonable standards."

To obtain the cleaning of larger areas in a given time, machine methods have been resorted to in the shape of horse-drawn brooms. These are rotary brooms mounted upon a frame and operated by a gearing to the axle. Their work is not as effective as that of the hand broom. The machine broom is preceded by a sprinkling cart to loosen the filth and in a measure to prevent the dust raising. This latter is seldom effected. Such a broom is found to cover about 40,000 square yards per 8-hour day. The materials swept are delivered in a windrow at the side and are finally delivered to a windrow in the gutter, from which they are picked up by the "white wing" with his shovel.

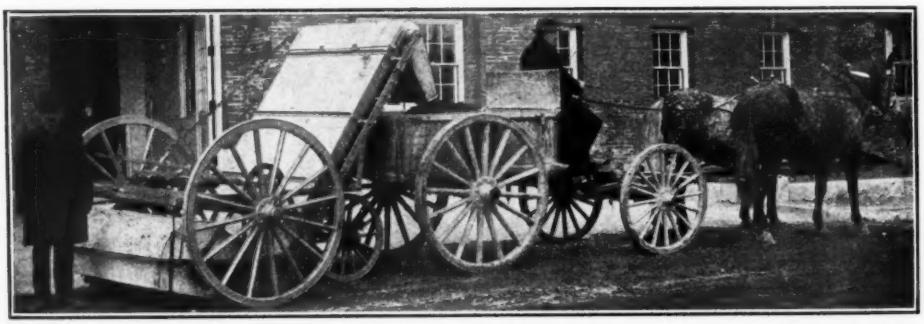
To improve on this method various types of "pick-up" sweeping machines have been invented and some built. Most of them have proved of no value. One upon which New York spent about $20,000 for testing, had many good points but weaknesses developed which were fatal, apparently thru lack of mechanical genius of the supervisors. A pick-up machine invented by a New York traffic-squad policeman has been tried out and found to be of value. It sweeps the dust upon a conveyor from which it is emptied into cans.

The principal defect in machine broom work is that the operation of sweeping depends upon the speed of traction of the vehicles. Thus particularly filthy spots do not receive special attention. If the work of the broom was independent of the traction, better results would undoubtedly be obtained.

Dr. Cronin says: "Dry sweeping is a barbarous, criminal procedure, but we can't get water to wet-sweep, so we move the dust from one spot to another and collect some of it. It is more criminal than street expectorating."

The present state of the art of vacuum cleaning has led many to endeavor to apply it to street cleaning operations and

A PICK-UP STREET SWEEPER *dropping sweepings into a detachable cart, each cart in turn hauling the sweeper until it has received its load and then detaching to carry load to dump.*



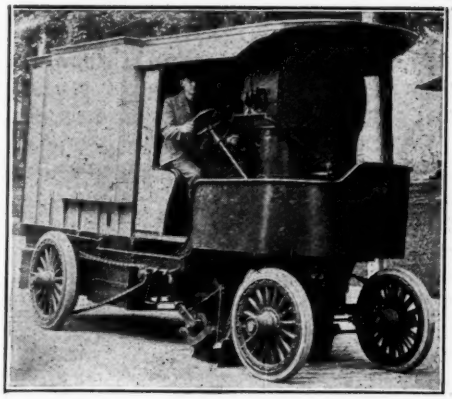
there seems no good reason to doubt the success of such application. But attention must be paid to the particular requirements and some difference in principle must be applied from that of the household cleaner. One such machine having a large intake and providing for a circulation of the air instead of its expression thru a filter, has been constructed and proven fairly effective.

The solution of the problem along these lines would meet with popular approval and at the same time should result in increased efficiency in street cleaning work. The problem, however, is not an elementary one and deserves the study of high class mechanical brains.

The vacuum machine will not pick up wet materials and probably need not, so time may be saved by not attempting to overcome this apparent difficulty.

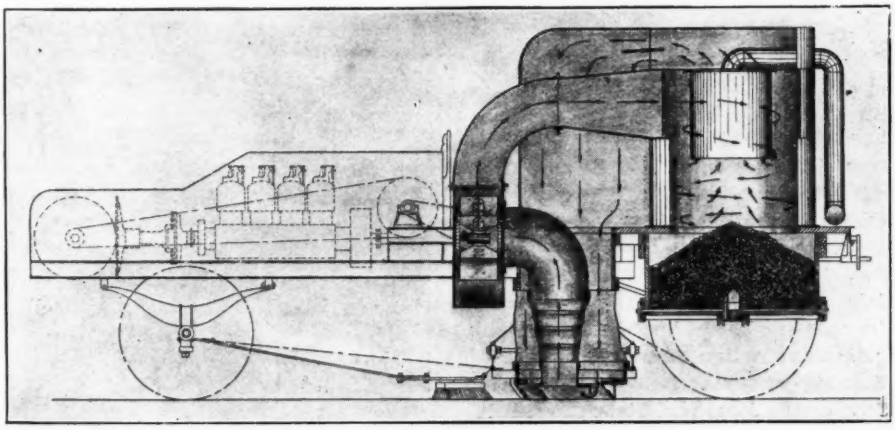
It is an axiom that "rain is the street cleaner's best friend." During a rain storm the work of the "white wing" is much more effective than during dry weather. Water is as necessary for obtaining good results in street cleaning as it is in house cleaning and for practically the same reason. The use of a sprinkling cart alone is of no value, is a temporary makeshift and the result is nil.

Hose flushing is ineffective and uneconomical. The water does not reach the pavement in such a manner as to give full effect and usually is doing no work at all. Dr. Cronin says: "Four or five sweepers hold a hose and play it in some sections as tho their object were to wash away asphalt, block pavement and car tracks. Target shooting with a stream of water, so-called flushing, will never supplant wetting and scrubbing." Water to be effective must reach the pavement surface in a chisel shape and at the proper angle to loosen and carry off the filth. No man is properly constructed to permit of his retaining the position necessary to hold the hose at a proper angle with the pavement to obtain the best results for any length of time. A test in New York



A SMALL MOTOR *street sweeper with air suction and removable dust boxes, invented by B. Kern.*

SECTION *of the Furnas pneumatic cleaner with circulation of air. Section of his latest machine operated by gasoline motors.*



City showed that this method gave only two-thirds of the result obtained by a flushing machine, used four times the amount of water per unit of area cleaned, and cost almost twice as much per unit.

One gang of hose flushers did about 26,000 square yards per day of eight hours and used about 1,600 gallons of water per 1,000 square yards. Street flushing machines are made which do effective work with a reasonable amount of water. These machines consist of a barrel of usually 700 gallons capacity, mounted on wheels. There is also a chamber within the barrel for the storage of compressed air. The outlet pipes from the storage are fitted with fan-shaped nozzles fitted with swivel joints. The water in filling the barrel compresses the air in the barrel and that contained in the water and this compressed air is automatically held in the air-storage compartment until use is to be made of it. The nozzles are adjustable to the angle most effective for use on the particular kind of pacement.

These machines have done excellent work and are pretty generally used, except in New York where they are most needed. One adverse feature in this machine is that the pressure gradually lowers when the air is released until it reaches about 10 pounds and becomes ineffective. The result is that not all the water in the barrel is used before refilling. This feature has been improved by putting a rotary pump, operated by a gas engine, on the machine and not attempting compression of air but giving positive pressure.

These machines clean about 35,000 square yards per machine per day with the use of about 400 gallons of water per 1,000 square yards.

Objection is made to flushing methods because the materials are washed into the sewers. The same objection might be made to hand sweeping, as many sweepers are like some housemaids and sweep the dust into the catch basins to make work eash. The materials need not reach the sewers if the operator knows his business. Many fear that the action of water when used in flushing will wear away the pavement surface or the joint materials. It should, if such a class of pavement or of jointing is allowed to be laid, to expose the paving contractor.

Machine squeegees have their value. They have a spiral rubber scrubber which acts like a hand squeegee and does a proportionately greater work. As usually constructed, the tank of water is on the machine and the discharge is too close to the scrubber for the best effect. If a sprinkling cart is used in advance better results are obtained. In New York, where no sprinkling cart is used, they average 51,000 square yards per machine per day with the use of about 200 gallons of water per 1,000 square yards. In Washington, with a sprinkling cart, they get about 80,000 square yards per machine per day.

There is little value in giving costs in any city, as local conditions govern, prices paid for labor, etc., vary so widely. In New York, however, the costs are approximately per 1,000 square yards:

Hand cleaning	32	cents
Machine broom	32	"
Hose flushing	65	"
Machine flushing	39	"
Squeegeeing	21	"

The system for cleaning streets of the future will be a combination of dry and wet methods; machine work at night and hand broom in the day time. White wings will only be used to remove coarse litter; the machines will take care of the dust.

Street cleaning is an art and deserves serious study. Waring understood this and was ridiculed for taking his work so seriously, but others have believed the

THE HORSE-DRAWN SQUEEGEE *with sprinkler pipes between the axles ahead of the squeegee cylinder.*

same and today each large city has its expert, giving this item of municipal activity proper thought. The first endeavor should be to get better work for the same cost and then lower costs.

There are no good-enough methods unless they are the best obtainable and efficiency is not measured by the cost alone.

Dr. W. V. V. Hayes says: "With the disappearance of the dust nuisance, New York would become one of the most beautiful, healthful and delightful of the large cities of the world," and it should be. Edward T. Hartman says: "The streets in many respects bear on the social life of the community, and until our streets are better constructed and more carefully maintained, we cannot claim for ourselves a high degree of intelligence or a progressive public opinion."

THE ETNYRE STREET FLUSHER
with constant water pressure.

SUPPRESSION OF BILL-BOARDS

Most bill-boards are so objectionable that one would not consider them improvements, but one method of suppressing them is to consider them as improvements to the property on which they are located and to assess them for taxes as other improvements are assessed.

Their forced sale value being no more than their junk value, the assessor would be obliged to consider their real value to be their income-producing ability. A capitalization of the rental paid for their presence on the property could be added to the valuation of the property obtained from a consideration of the other sources of its value, whether as a revenue-producer or, from its location and condition, as a prospective or possible revenue producer.

The owner of a bill-board is ordinarily not the owner of the property on which it is located, so that the "improvement" has value additional to that which it possesses as a producer of revenue for the property owner, thru the rental which he receives. Whether as an improvement of the real estate on the value of which he should be taxed as the owner thereof, or as personal property, it should be possible to reach the owner with a tax somewhat proportional to his net income from it, possibly by taxing the capitalized value of this net income as the value of the property.

The possibility and the method of reaching the proper person, directly or indirectly, by this taxation will depend upon the laws of the respective states, and the effect of such taxes upon the existence of the bill-boards will depend upon the magnitude of the tax which is assessable upon them.

License-fees are tried in some cities with success and in some states can be assessed in addition to taxes on property values.

THE MUNICIPAL ASPHALT PLANT

OF CHICAGO, ILLINOIS.

By Walter G. Leininger, Superintendent of Streets, Chicago, Ills.

The city of Chicago has joined the enlarging group of cities operating asphalt paving plants and repairing their own asphalt streets. In January of this year MUNICIPAL ENGINEERING *published a description of the asphalt heating and mixing plant, to which reference may be made for details. This paper by the man responsible for the work describes the additions made to the plant for the use of the gangs doing the paving work and gives figures of work done, men employed and cost of operation.*

IN all cities where repair work is done by contract, the sum of money expended is large in proportion to the yardage repaired, and in order to get repairs done quickly by this method, a great deal of time is expended in notifying the contractor and estimating and finally settling on the work actually done. The city must keep all records of yardage, cost, etc., just as completely as if they were doing the work themselves. Hence, when the bureau of streets decided to do their own asphalt repair work, it was necessary only to add a field force to the men already engaged in this work. The first year that any attempt was made to repair by day labor, all material was purchased at the plant of a contractor. The hauling and placing was carried on by the street department. Chemical tests were made of all material purchased, and altho the mix and material was good, the bureau had no opportunity to try a new method, mix, or material, where they felt the same might give better results. It was the necessity of a plant for this purpose, and the cheaper manufacture, that resulted in the building of the present municipal asphalt plant of the city of Chicago.

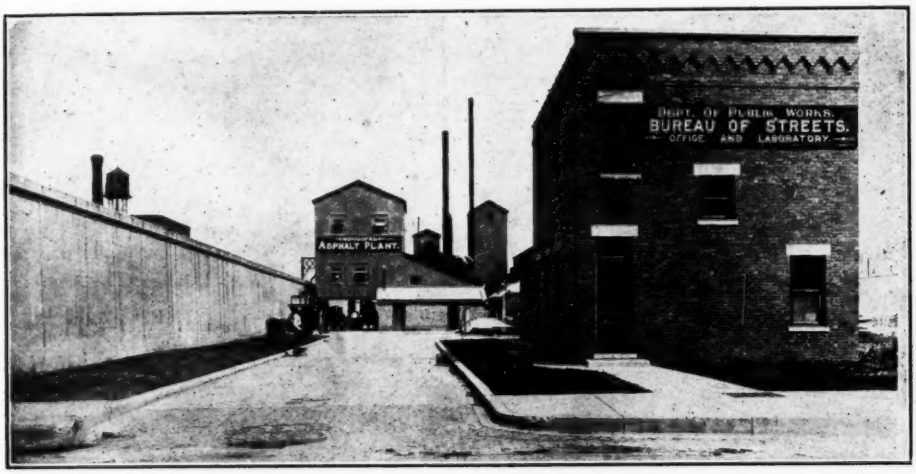
The next problem that confronted the department was the location. It should be centrally located to the area of asphalt streets or contemplated asphalt streets. The location chosen was first considered by many as unfit for such an undertaking, Fifteenth Place between Loomis Street and Ashland Avenue, is 66 feet wide and is bounded on both north and south by elevated steam railroads. The walls supporting these tracks are 17 feet in height and afford an ideal side track where material can be unloaded into bins along the wall, or lowered in the elevator constructed for this purpose.

The plant proper was constructed by Hetherington & Berner, at a cost of $46,000.

The department then took up the matter of additional buildings to be used as office, scale house, chemical laboratory and baths. The plant today represents approximately an expenditure of $75,000.

The plant can be utilized for the manufacture of top, binder or bituminous mixtures, and has a rated capacity of 2,000 yards of finished pavement per day of eight hours. By finished pavement is meant two inches of top and two inches of binder.

The plant is run on a different basis from other cities. A credit of $75,000 was placed at the disposal of the plant, the same to be known as a capital account. This amount gave the plant the required money with which to purchase supplies



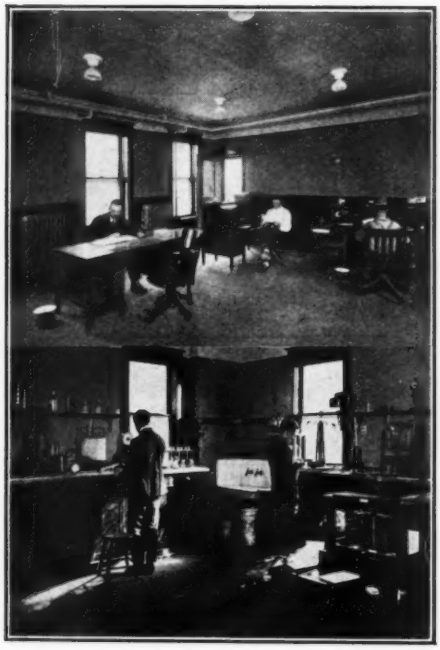
CHCAGO ASPHALT PLANT. *Entrance for visitors and exit for loaded wagons. Office on right with chemical laboratory in right side and store room in rear. Scale room, office and bath room in building next in rear. Asphalt heating and mixing plant in center at rear. Elevator for unloading cars on switch track seen in rear and between office and plant buildings. Sand and stone dust storage seen at right of asphalt plant. Asphalt storage at far rear of lot. Car service track on the right, elevated. Elevated railroad tracks on both sides.*

and material for the year's work. Each of the thirty-five wards in the city is credited with a certain per cent of the vehicle tax fund, based on the amount of collection in that particular ward. Hence, when the plant is furnishing material for any ward, it is charged for at a standard price per ton; this price is sufficient to allow for all overhead expenses plus depreciation. It is interesting to know that these prices are much lower than could be procured by contract. The charge for top mixture is $7.50 per ton, for binder $4.50 per ton and for bituminous macadam $5.00 per ton. The actual cost to the plant for top is $5.75, for binder $375 per ton and for bituminous macadam $4.00 per ton. Hence, during the operation of the plant an earning of $4,000 average per month will be shown. This earning holds the capital account stable and allows for all depreciation, repairs and the like.

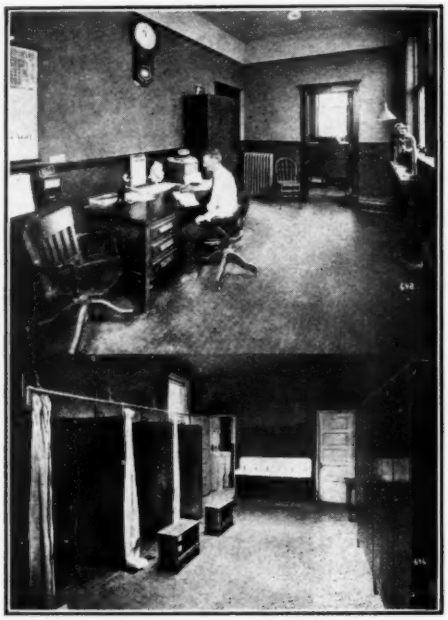
The asphalt repair division is under direct supervision of a general foreman of asphalt repairs, who reports directly to the superintendent of streets. In this way, rapid operation and decision is acquired.

Upon entering the plant from Ashland avenue, at the right stands the office of the plant foreman, above which is the chemical laboratory. First behind the office is a long storage room where parts and tools for all kinds of asphalt work are held in reserve. The next building to the right is the office of the scaleman, where all material is weighed as it leaves the plant. Just behind this office are the locker room and shower baths. Here the men dress and wash and at the close of the day's work leave the plant refreshed and clean.

All apparatus in and about the plant is of the latest and best type. The chemical laboratory is in charge of a chemist and his assistant, who employ two samplers. The laboratory is light and airy, well ventilated and fitted with hoods in which all gases are carried off. All testing apparatus is of the best, and arranged in the most efficient manner. All materials used in connection with the plant and the work are tested by standard methods to insure the best results and to obtain a good compliance with the bureau's specifications. Copies of all tests are placed on file in the bureau, and a duplicate is retained at the plant. In this way all department heads, inspectors, etc., are kept in touch with the class of material being



CHICAGO ASPHALT PLANT. *Above is the interior of the office and below is that of the chemical laboratory, situated at the right of the room shown in thv upper picture.*



CHICAGO ASPHALT PLANT. *Above is the interior of the scale room with scale at the right and office room in the rear. Below is the bath room and lavatory, with lockers for the men at the right. Both rooms are in the same building.*

used. All requisitions for material bear the signature of the chemist, showing that the material is correct in all respects. Not only raw material but the mixtures made for repairs are tested from time to time, so that at any time the mixture used on any job can be ascertained and the results of wear noted. All entrances to the plant are paved with granite block and all portion kept in excellent condition by the watchmen. A sewer directly thru the street takes care of all drainage of roadways and pits. All storage tanks are placed underground where practicable, and encased in concrete. The plant is electrically operated and lighted so that it can operate at night if necessary. This current is furnished by contract from the Sanitary District of Chicago at the regular rate for plants of this nature. The force which has been found necessary in order to operate, includes:

1 Foreman of asphalt plant.
1 Foreman of drum men.
2 Drum men.
3 Kettle men.
1 Mixer man.
15 Laborers.
1 Chemist.
1 Assistant chemist.
2 Samplers.
2 Watchmen.

The street repair gangs, which range from two to five in number, depending upon the amount of work and the period of the year, are composed of the following:

1 Foreman of asphalt repairs.
1 Foreman of cut outs.
3 Rakers.
3 Smoothers.
3 Tampers.
30 Helpers.
1 Roller man.
2 Watchmen.

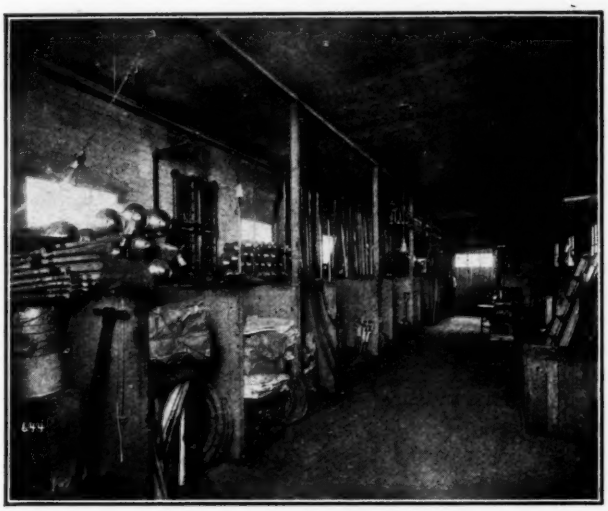
With each gang are sufficient teams to keep material constantly at hand and remove old top. The hauling of material will be greatly improved and cheapened in the near future for the bureau has

purchased two five-ton Pierce-Arrow dump trucks to assist in the long hauls. It is estimated that each truck will take the place of 3½ teams on this work.

The first attempt by the bureau in 1912 to repair streets out of reserve was done by contracting for material at the plant of a contractor by the ton. Hauling and laying was done by the city's forces and altho the cost of material was high, the results were pleasing and the work was of a high standard. This high standard is showing more and more each year by the decrease in the yardage to be repaired on streets where careful work was done.

In the first year's work the following will give an idea of the saving even by the purchase of a contract mixture:

Out of reserve and maintained in 1912, sq. yds. asphalt...	2,059,000

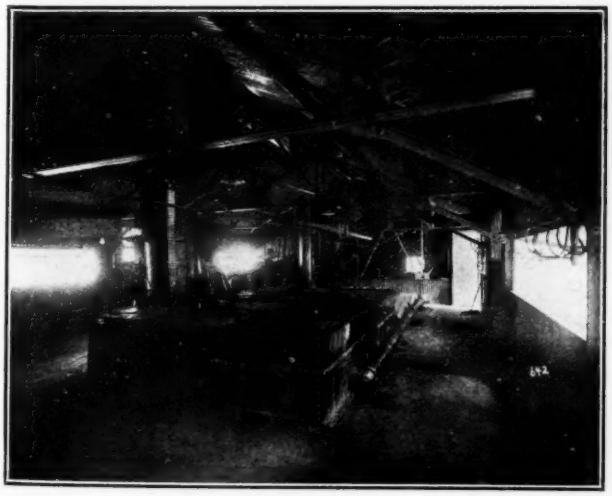


CHICAGO ASPHALT PLANT. *Store room in rear of office. Note completeness of outfit and systematic storage so that any article needed is quickly found.*

Total sq. yds repaired.....	76,488
Total cost of repairs.....	$105,160.52
Average cost per sq. yd.....	1.375
Average cost of maintenance per sq. yd.....	.051

Previous to this time all repair was done by contract, and a fair average of maintenance cost was about $.06 per square yard.

CHICAGO ASPHALT PLANT. *Second floor, showing flux, asphalt melting and mixing tanks in room in foreground; upper end of sand and stone elevators and conveyors in rear room; both discharging into mixers in room at right of the latter.*



The first year of operation with the plant was 1913 and the results are exceedingly encouraging, since the plant force was being broken in and the new machinery worked hard, as is usual with a new plant of this size. The system of getting material, unloading and storing the same in convenient places, was also a new proposition and the storage bins were not then completed. Nevertheless, considering all the drawbacks to the opening and operation of a new plant, the following results speak for themselves:

Out of reserve in 1913, sq. yds. asphalt	4,309,200
Maintained by the bureau in 1913	3,547,600
Total yards repaired	147,638
Total cost of repairs	$119,828.63
Avg. cost of repairs per sq. yd.	.8116
Avg. cost of maintenance per sq. yd.	.0338

We are looking forward to another decrease in the cost for the present year. Just what the cost will be cannot now be estimated, since the quantity is large and the bureau has been reaching out in other lines.

The proposed repair work for the year is laid out on a small map by the general foreman in charge. Care is taken to district this work in a manner that will require the shortest moves and a system of streets is repaired in one location before moving on to the next. The first move made upon the arrival of the gang upon a street is to mark out the cuts to be made and holes to be repaired. This is done by the foreman of cutouts, and passed upon by the general foreman. As fast as the cuts are made and trimmed, the old material is gathered up and taken away. The painting of the edges is next completed by using asphaltic cement. The binder gang then follows up, bringing up the repair to within an inch and a half to two inches of the top. The binder is tamped and smoothed, ready for the top. The top is then laid, raked, smoothed and ironed; after rolling with a five or eight-ton roller the top is dusted with cement and barricaded with wooden horses until ready for opening the street to traffic.

Record of all asphalt streets in the city, as well as those of other materials, is kept by map and card index. All streets under the contractor's reserve are placed on the map under a distinct color in dotted line, and as soon as this street falls to the city to maintain, the line is made solid. All dimensions, data, etc., pertaining to this street are filed alphabetically in a card-index file and on the reverse side a complete record of repairs is kept, showing yardage repaired, cost, etc. In order that the superintendent of streets may keep in constant touch with the various repair gangs, a map with colored thumb tacks showing the loca-

BOTH SIDES OF CARD *used for keeping record of asphalt repairs in detail.*

Madison St

Ref. No.	From	To	Date of Contract	Date of Expiration	Contractor	Ward	Width Roadway	Width Pavement	Length	Yardage	Kind of Pavement	REMARKS
1	Canal	Clinton	95	00	Cilvico	18	16.3	14.3	340	616	Asph.	Macadam base
2	Clinton	Racine	97	07	Conway	18	48	48	1188	15988	"	Concrete base 6"
3	Racine	Ashland	97	07	Barber	18	48	48	2567	9915	"	" " "
4	Ashland	Robey	98	08	Ryan	18	48	48	2004	9856	"	" " 8"
5	Robey	Oakley	98	08	Columbia	18	43	43	2504	8094	"	Resurfaced Brick
6	Oakley	Western	99	09	Barber	13	43	43	619	1225	"	Concrete base 6"
7	Western	California	00	10	Conway	13	44.5	44.5	2261	6739	"	" " 8"
8	California	Homan	01	11	"	13	48	45	3903	12941	"	" " "
9	Homan	Central Pk.	02	12	"	13	49	46	1290	2192	"	Sheet & concrete
10	State	Michigan	03	13	Barber	1	47	39	946	3459	"	concrete base
11					Front of Guard.							
12												

Year	Ref. No.	Inspector	Contractor	Total Yardage Repaired	Per Cent.	Field Book	Cost of Maintenance	Maintenance Cost Per Yd.	
1912	10	Fisher	City	231	6.68	7/12	500.62	0.145	2½" Top
"	6-7 8-9	Dillon	"	785	3.39	8/20	1288.73	0.056	2" Top
"	1-2-3 4-5	Brown	"	4226.5	9.5	8/22	7240.74	0.163	2" Top 1½" Binder
1913	10	Crowley	"	57	1.65	15/2	77.30	0.022	2½ Top 2" Binder
"	6-7 8-9	LaVelle	"	1720	7.45	15/6	1521.56	0.066	2" Top
"	1-2 3-4-5	Dooley	"	4875	10.96	18/3	4671.72	0.105	2¼ Top
				Back of Card					

tion of each gang is kept. A location report is sent to the office of the bureau each night, by the various foremen, and the plat is kept up to date in this way. The location of road rollers is noted by the same method and in this way the shortest moves for the machines can be planned by the assistant superintendent in charge of repairs. Each roller bears a number. The duplicate of this number appears on the location map.

The total capacity of the storage bins is approximately 860 cubic yards of sand and stone. The cement is kept in a brick-lined room, air and water tight. Five hundred barrels of cement are kept in readiness for use at all times.

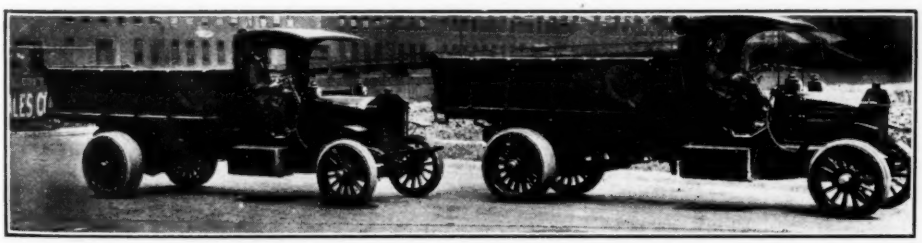
From the storage bins the material is carried by conveyors to the hoppers located at the top of the plant. From these hoppers it is fed to the different mixers as required. After mixing it is conveyed to the wagons and arrives on the job at from 280 to 320 deg. F.

Each wagon is loaded in approximately ten minutes, and top and binder can be loaded at the same time, there being two mixers. Besides the manufacture of top and binder, the plant turns out all asphaltic filler required for brick and granite block repair. The liquid asphalt used for building macadam streets by the penetration method is also made at the asphalt plant. The plant is at present using the following brands of asphalt: Trinidad Lake natural asphalt, Cuban and different brands of blown oil product.

The department this year purchased twenty 3-yard asphalt wagons. When other wagons are needed they are hired by the day. The city owns no horses. The largest number of asphalt wagons working this year was sixty and this number varies from time to time a great deal, depending on the length of haul.

In the beginning, naturally all eyes were focused on Chicago in this undertaking, and co-operation was not asked nor expected from outside concerns interested in the asphalt work. The success of the undertaking is based on hearty co-operation of the city's forces and the interest displayed by the competent men in charge. The best material linked with care and pains in laying the same have insured the best results. The experiments carried on from time to time on new mixtures and the action under traffic carefully noted, give the men in this work the ability of quick decision and choice on streets coming up for repair. At the present time the resurfacing of old granite block and brick pavement is being carefully watched. These results will be known in a year or so. Each year more and more asphalt pavements besides those of other materials run out of the contractor's reserve period, and fall to the bureau of streets for maintenance. Naturally, it is to be expected that the present plant and equipment will be inadequate to supply the wants, and in the future an additional plant, of size and capacity necessary, will be required. This plant will be located at a central point to the increased area. So far it has not been necessary to run the plant at the maximum capacity and we are not positive of the overload it is capable of caring for. It is also a fact, that with a few slight changes or additions, the present capacity of the plant can be greatly increased.

TYPES OF FIVE-TON TRUCKS *used for hauling hot asphalt mixture from plant to street.*



PAVEMENT ECONOMY

By H. B. Pullar, Engineering Chemist, Detroit, Mich.

In this paper before the League of Michigan Municipalities the author, who has had much experience in bituminous pavements of various kinds, presents some of the important factors in the economy of pavements, especially as to the necessity of taking local conditions into full consideration. The editor has selected some illustrations, not to point the moral of the author's paper, but to show what good results can be obtained with kinds of pavement he excludes from his consideration. Part of these have good results because economy is a secondary consideration and the roads receive all the attention they require to keep them in good condition. Part of them are built of the closed types mentioned by the author. He promises a paper later descriptive of a pavement of the open type which he commends.

THE economical pavement is a subject of much discussion, but like the proverbial fountain of youth it still remains undiscovered. Many claims have been made for the different types of pavements on the market and almost any promoter, material man or contractor, believes that he can, if given the proper amount of time, convince you that his is the only economical pavement. The truly economical pavement is the one best suited to meet the local conditions which will withstand the ravages of time and traffic with the least possible maintenance, first cost considered.

The old Roman roads with their foundations two or three feet, and in some cases as much as six feet in thickness, were economical roads and pavements for their time, for they not only met the conditions of their time, but have stood the traffic of centuries. To build a Roman road in modern times, however, would not be economical or wise. An American administration attempting to lay a Roman road would probably not only start a vigorous protest of abutting property owners but would find a quick demand for a change in administration. While the history of the old roads of the Roman Empire, France and England, is interesting and they have been of great service in the development of modern type of pavements, they can no longer be used as models.

Americans, with their nervous, progressive and energetic spirit must solve their own paving and road problems to meet their own particular conditions.

The principal considerations in determining the economical pavement are the traffic and climatic conditions to which the pavement must be subjected, available materials and their cost, assessed valuation of abutting property, and the probable result of the improvement.

Before a pavement is laid the climatic and traffic conditions should be given most serious consideration and should be a big factor in making the final determination. In the large cities where traffic is heavy, granite or wood block are very largely used. This is because these two types of pavement have been found to withstand heavy traffic more satisfactorily. Where the question of excessive noise is not material, the long life and small difference in cost, and the ease of repairs and low cost of maintenance, make granite block the favorite; while on a heavy traffic street lined with office buildings or stores, where the question of noise must be taken into consideration, wood block is constantly increasing in favor. It would be folly indeed to lay a concrete

WATERBOUND MACADAM *on Vernon Road in the city of Philadelphia, showing successful maintenance by resurfacing by city forces, without regard to relative cost of maintaining various kinds of pavements.*

pavement, bituminous or water bound macadam, or any other cheaper type of construction under such conditions. In considering the traffic conditions to which a pavement must be subjected it is always necessary to take into consideration the probable increase in traffic after the pavement has been laid, and in many instances it is advisable to take traffic census for the proposed improvement. It is not uncommon for the traffic of a road or pavement to double in volume after the improvements are made.

Another very important matter in considering the traffic conditions, is the kind of traffic. Where horse-drawn traffic prevails, a pavement should be made to aid this class of traffic; and where motor traffic prevails, a different type of pavement entirely may prove to be the most economical. Probably one of the best examples of this kind can be cited in Wayne County, Michigan. Almost everybody interested in paving has heard more or less favorable comments as to this large mileage of concrete roads. Cement manufacturers and promoters have advertised these roads from one end of the country to the other, but in trying to convince you that concrete roads will be the most economical pavement for you to lay and in telling you about these Wayne County roads they usually forget to give all the facts, and fail to realize that because in Wayne County or some other place concrete has given successful results, it will not necessarily prove to be successful for your own work. The traffic on the Wayne County roads has been reported as being over 80 per cent. motor traffic, and a large per cent of this motor traffic is pleasure vehicles. The roads are and have been constructed by the most up-to-date methods and repairs are made immediately any defects appear. Were these conditions reversed, and the concrete roads in Wayne County compelled to withstand over 80 per cent. of horse drawn traffic or even a much higher percent of heavy commercial car traffic, they would probably not prove to be the most economical,

and the reported low cost for repairs and maintenance would be considerably increased.

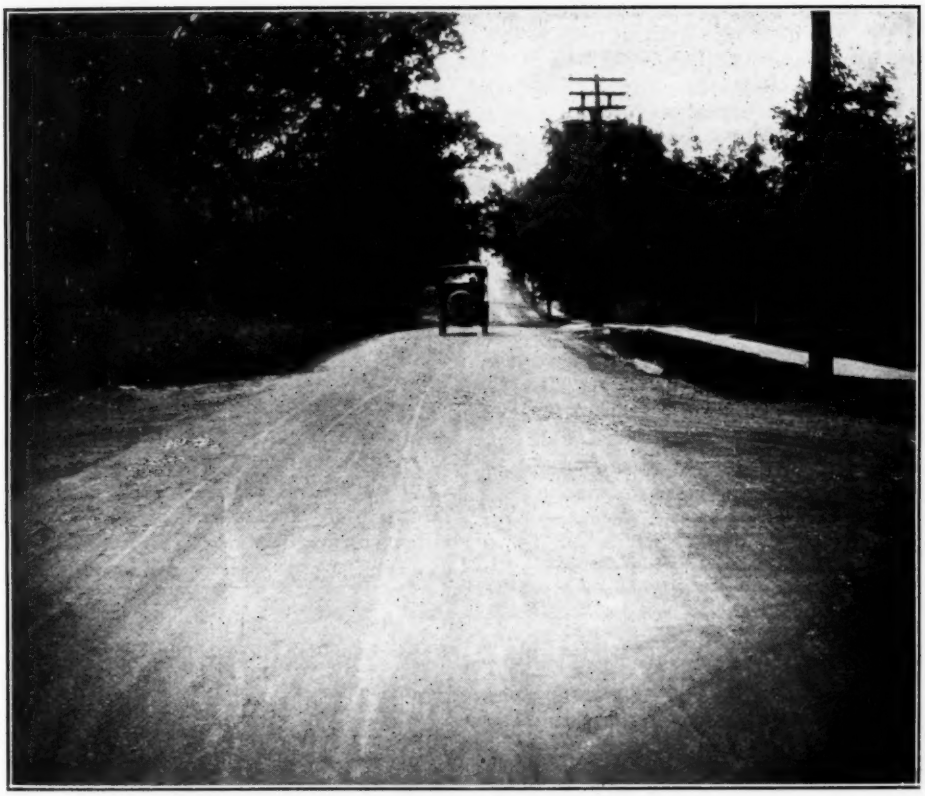
Climatic conditions should be given consideration when determining upon the most suitable type of pavement. In England it was found that asphalt pavements laid similar to those in America deteriorated very rapidly, and the cause was found to be the heavy fogs. A higher percentage of asphalt was used to overcome this trouble and more successful results were obtained. The southern part of this country requires a bituminous material of different consistency than that used in the northern section.

Bituminous pavements to give most successful results must have suitable drainage, and while this is true of other pavements it is specially true of all bituminous work. The climatic conditions of Michigan permit the use of many and various types of pavements, and they are not as important a matter as in other parts of the country.

The availability of materials is often given but slight consideration in determining the type of pavement to be constructed, and yet it is of the utmost importance in some localities. Where good sand is available at a low cost and where other conditions are equal, how foolish it is to import brick from another state in preference to laying sheet asphalt pavement, which is composed of about 80 per cent. of sand, whereas the reverse would be true if it were necessary to import sand into a town in which there is a brick plant turning out high quality brick. There are conditions in different cities which makes it advisable, even at a much higher cost, to favor one type of pavement over another, but where the truly economical pavement is desired and other conditions are equal, the availability of materials should be given careful consideration.

In determining the most economical pavement the assessed valuation of the property is too often considered to be of minor importance, and politics and real estate promoters are frequently the cause of sheet asphalt pavements being laid out in the country, while the old unreliable water-bound macadam pavement remains in the heart of the city. We find many instances where expensive wooden block pavements are laid on light traffic residence streets with heavy assessments made against the abutting property owners, who can ill afford them,

THE MALL, *Washington, D. C. Asphaltic macadam, treated with Trinidad liquid asphalt, penetration method. A fine example of a well-maintained driveway built by this method.*



BITUMINOUS SURFACE TREATMENT *on waterbound macadam on City avenue, a suburban street in the city of Philadelphia, maintained by city forces. Note tendencies toward raveling of surface in many places.*

while in the main business streets a cheaper type of construction is used with a heavy maintenance coming out of the general taxation fund. This practice is certainly contrary to all ideas of economy, and there has been much waste of public funds in cities where such conditions exist. A careful consideration of the needs of a street and the assessed valuation of the abutting property will not only result in better streets, but will cause a much lower general maintenance charge on all paving in the city and a more equal and just distribution of the paving fund.

The medical profession, with its great scientists and students, is continually finding new cures for what have been previously considered incurable diseases. Likewise the engineering profession, by its scientific studies and research work, will continue to overcome the numerous and difficult problems of paving construction. The economical type of pavement is distinctly an engineering problem and its solution for any particular street or locality will depend upon the efficiency of your engineer. The time is coming when the city engineer will be given more authority to direct and more opportunity to study and work out to advantage his paving problems. A successful manufacturer would soon lose his business and turn his dividends into losses were he to employ a new superintendent each year; as he would, also, if he should employ a capable superintendent to look after his business and then only spasmodically assist him in his work, or fail to give him authority to go ahead. So the choice of the economical pavement must be left with a capable engineer, receiving a big compensation and with full authority to

direct his work, and in this he should receive the co-operation and help of all officials and citizens.

While I have endeavored to give you a general idea as to some of the important features to be taken into consideration when deciding upon the economical pavement for your city or town, I will endeavor to give you a short description and history of what we believe to be one of the coming types of economical bituminous construction. This is known as the open type of asphaltic or bituminous concrete.

With the advent of the automobile and the demand for a more permanent type of construction than the water-bound mecadam, the bituminous macadam laid by the penetration method was one of the first to be considered and has been most extensively used. For a time it seemed to have solved the problem, but failures have been too frequent and costly. While there are many good bituminous macadam roads which were constructed by the penetration method, the many small details which must be carefully looked after in order to get successful results have made the proportionate chances of failure so numerous that it is always with more or less uncertainty of results that a penetration job is constructed. The principal causes of the failure of bituminous pavements laid by the penetration method are the impossibility of thoroly coating each particle of stone and the segregation of the stone, making it impossible to obtain an even distribution of the bituminous material. The result of this is that there are numerous spaces in the road which allow water to penetrate, causing the pavement to disintegrate rapidly.

ROADWAY OF BUSTLETON PIKE *in the city of Philadelphia, resurfaced with Amiesite, showing good condition of this type of asphaltic macadam.*

Another type of bituminous pavement which has found great favor, is the bituminous concrete, which is a mixture of asphalt, sand and stone. This type of pavement would find greater favor were it not for the fact that certain patents to cover practically all mixtures of stone and sand have been held valid in some of the courts; and on account of the undesirability of getting into any patent litigation cities have hesitated in adopting this type of construction.

Because of the uncertainty as to the results obtained from the penetration work and because of the desirability of getting a cheaper type of bituminous pavement than the asphaltic concrete or sheet asphalt, the open type of asphaltic or bituminous concrete has been developed and has met with much favor in different sections of the country. This type of pavement, however, is not a new one, having been used many years ago with a tar binder. The pavement consists of a mixture of stone and bituminous cement acting as a binding medium.

The stone is heated to a suitable degree of temperature, depending upon the bituminous material used, and then mixed with bituminous binder in suitable proportions. It is laid similar to sheet asphalt or asphaltic concrete. The mixture is laid from 2 to 3 inches in thickness

and properly rolled. After rolling there is applied a squeegee coat of pure asphalt cement and while the coating is still hot stone chips are thrown over the surface. The whole pavement is then re-rolled so the squeegee coat is forced into the voids, making a tight, uniform, waterproof and and durable surface. Heating the stone and then mixing in asphalt so that each particle is thoroly coated, prevents the trouble which causes so many failures in the penetration method and prevents any segregation of stone.

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¶ PRACTICAL EXAMPLES *of the open type of asphaltic concrete pavement exist in Michigan and others are under construction.*

The city of Lansing last year tried out this type of pavement on some of the principal streets with most excellent results at a very low cost. On account of the results obtained at Lansing, the State Highway Department of Michigan will put in a strip of this same type of pavement in Oakland County, which is an extension of the Woodward Avenue pavement of Detroit. This section of pavement will join the concrete road of Wayne County and will afford an excellent opportunity for a comparison of the two different types for the same traffic. There are a number of other cities in the state which have already laid considerable yardage of this open type, and which contemplate laying in the future a large amount of this work.

The open type of asphaltic concrete pavement is free from infringing on any patents, thus removing any cause for litigation. Although there are about 35 per cent. of voids in the mix as it comes from the mixer the stones key in together giving the wearing surface stability, thus preventing shoving and rutting. In fact, the finished pavement is similar to water-bound macadam with the exception that each stone is bound together with asphalt cement. The asphalt cement prevents any dislodgement of the stone from either horse-drawn or motor traffic.

The first cost of this pavement is very nominal compared with other types, being slightly higher than that of the penetration and considerably less than the closed type of bituminous concrete or sheet asphalt. With the average conditions in Michigan these pavements can be laid by contractors for from $1.10 to $1.40 per square yard, including 6-inch concrete foundation, but if the pavement is put in by the day labor plan, under the supervision of the city engineer, the cost should be considerably lower. In fact, I believe the total cost of the paving at Lansing did not exceed $1.10 per square yard, and the city used crushed cobble stone instead of limestone, which added considerably to the expense.

The open type asphaltic concrete pavement after traffic has been on it for some time looks almost the same as the closed type, or like bitulithic. It is easy to repair, pleasing in appearance and makes a sanitary and noiseless pavement. There are many cities and towns thruout Michigan, especially in the residential sections, where this type of construction would be advisable. I think it would prove to be the economical pavement and I believe that it will constantly grow in favor with engineers and officials in charge of paving work.

There is another item to be taken into consideration in discussing the economical pavement. No type of construction and no materials, no matter how high the quality or how successful they have been in other places, will be satisfactory in any locality unless they are properly constructed. Just because a pavement or a particular type of construction has given successful results in one town or one locality is no indication that it will be equally successful in your city or town unless every precaution is taken to see that the numerous small but important details are carefully looked after. The best of materials cannot give good results unless properly handled, while better results can be obtained with poor materials properly applied.

It is not, by any means, always economical to award contract to the lowest bidder and a difference of 5, 10, or even 25 or 50 cents per square yard in the original cost may in the end prove most economical.

In conclusion, I would state that the

economical pavement of today is not any particular type or any particular material, nor is it a pavement put in at any particular cost. It is a pavement carefully selected after an exhaustive preliminary examination by an efficient engineer to best meet the demands of the particular locality in which it is to be constructed. It is a pavement laid in direct accordance with the requirements of carefully prepared specifications, which should be reasonable and just to both the city and contractor. It is a pavement in which only the most suitable available materials for its particular type of construction are used; a pavement laid under the direction of an efficient and capable engineer, with authority to direct and supervise the many details of construction and to appoint inspectors for their efficiency and ability to carry out his orders, rather than for their ability to obtain votes at the next election. The city or town in which this condition exists, while it may continue to have a failure now and then, and while it may not find the one economical pavement, will come nearer to solving the problem and satisfying the tax payers, to whom all public officials in the end must look for commendation.

DARTMOUTH STREET, *Boston, Mass., laid with bitulithic on macadam foundation in* 1903, *as it appeared in June,* 1914, *showing durability of this type of bituminous pavement.*

SEWAGE DISPOSAL

AT BERGEDORF, GERMANY.

By Kenneth Allen, Consulting Engineer, New York City.

The author of this clear description of a new sewage disposal plant in a suburb of a large city has recently returned from a trip thru Europe for observation of foreign methods of treating modern sanitary problems, for which he has been well fitted by years of successful practice in the same field in this country. His report of what he has seen is therefore of more than usual authority.

THE "Free and Hanseatic City of Hamburg" is in many respects an autonomous state, possessing, like Bremen and Luebeck, certain powers and privileges not held by other German municipalities, and the territory covered may include areas separated from the city proper. The village of Bergedorf lies on such an area, about ten miles southeast of the center of Hamburg, on a small stream which enters the Elbe above the city. On account of this location the Hamburg authorities have recently constructed a plant for the thoro treatment of the sewage.

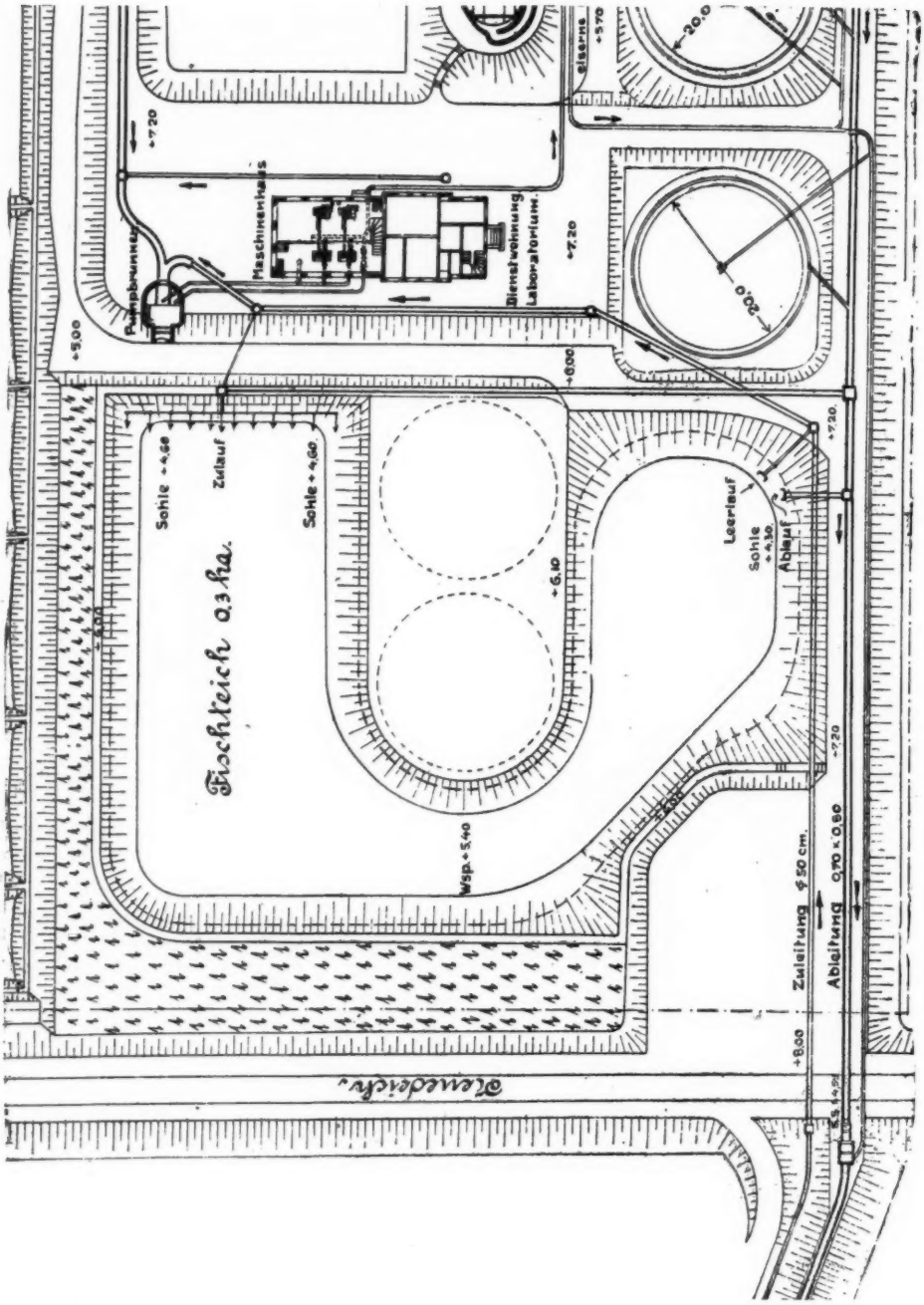
The population of Bergedorf in 1910 was 14,900, and the volume of sewage when visited in June, 1913, was estimated at 600,000 gallons (2,250 cu. m.) per day, exclusive of storm water. The maximum flow received by the plant contains over three times this amount of storm water, or 2.6 million gallons (99,000 cu. m.) daily, the excess passing by overflows to the stream. The sewage is quite fresh when received, as the plant is but 1¼ miles (2 kilom.) from the center of the town, but contains much manufacturing waste. It is brought by two trunk sewers to a pump well 13.3 feet (4 meters) in diameter by 9.9 feet (3 m.) deep, which also serves to intercept grit and which contains a screen of bars placed 0.64 in. (16 m. m.) apart, for the purpose of intercepting the coarse floating material.

Two 8-h. p. Diesel motors operate centrifugal pumps, each of 1.75 cu. ft. sec. (50 lit. sec.) capacity, during the day while a smaller, automatic electrically operated pump is used at night. The latter requires 3 h. p. and has a capacity of 1.05 cu. ft. (30 lit.) sec. Diesel motors were selected on account of their economy in operation. The fuel used is the by-product from the distillation of coal, lignite and petroleum and is consequently inexpensive, while the efficiency of the motor is very high, 33 per cent. The pumps lift the sewage about 20 feet (6 m.) to the plant.

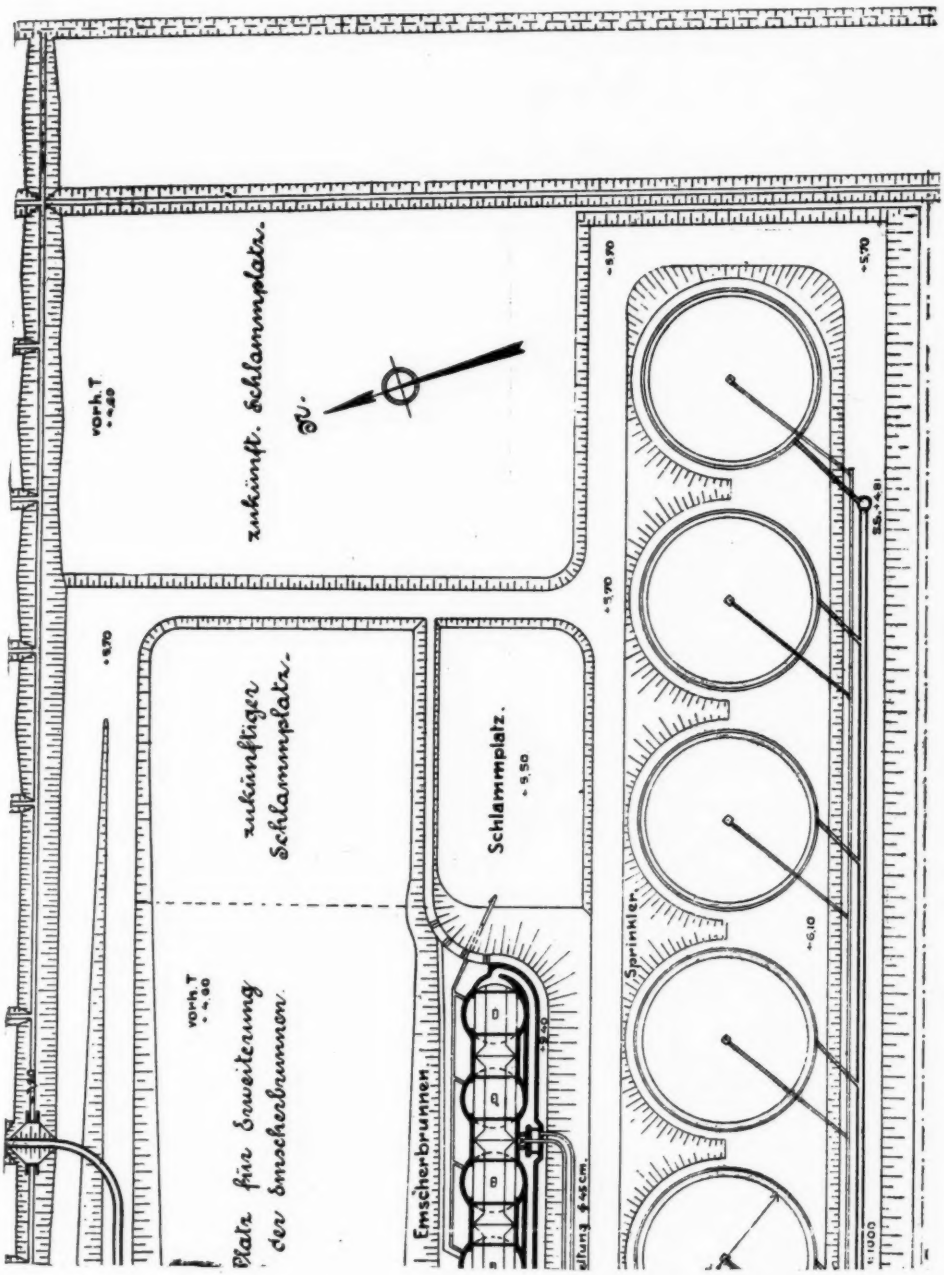
The works were put in operation in October, 1912, and consist of Emscher tanks, sprinkling filters and fish ponds.

There are four reinforced concrete Emscher tanks, operated in series or in two pairs, as desired. The sedimentation chambers are of a size to afford a 2-hours' period of retention for the dry weather flow and a mean velocity of one foot a minute (5 m. m. per sec.) and a period of retention of 40 minutes with a velocity of three feet per minute (15 m. m. per sec.) during storms. Here 67 per cent. of the suspended solids or 90 per cent. of the settleable solids drop to the sludge chamber beneath, where they remain three or four months (six months preferred) until digested. The sludge chambers are 23 feet (7 m.) in diameter and extend to a depth of 29.6 feet (9 m.). When visited, the actual depth of sludge was about 16.4 feet (5 m.)

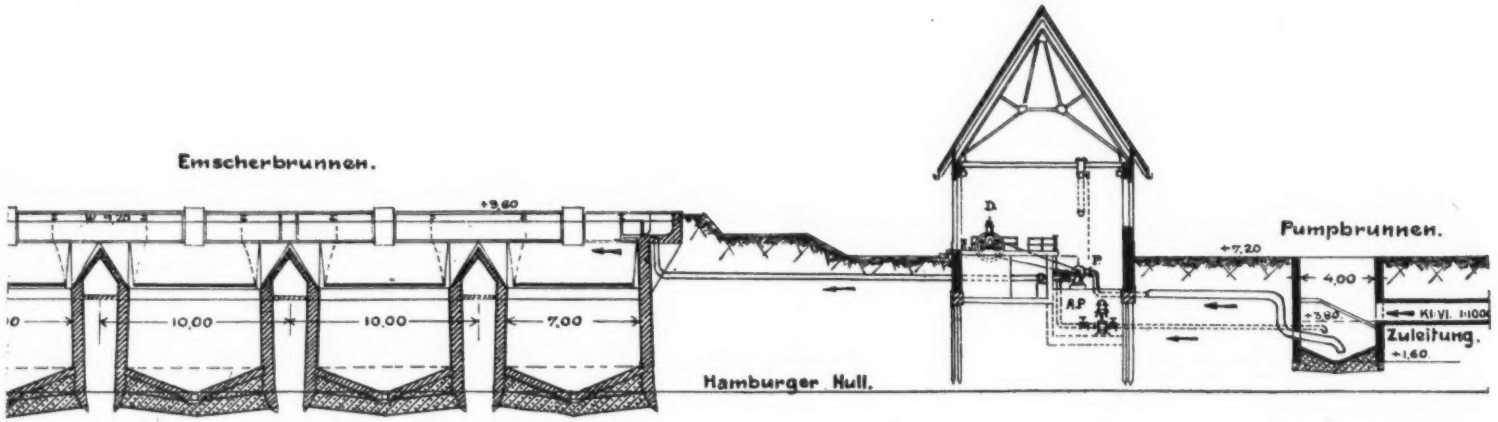
When drawn off by the hydrostatic pressure of the liquid above, the sludge was seen to be nearly black, of the consistency of syrup and with very little odor. After



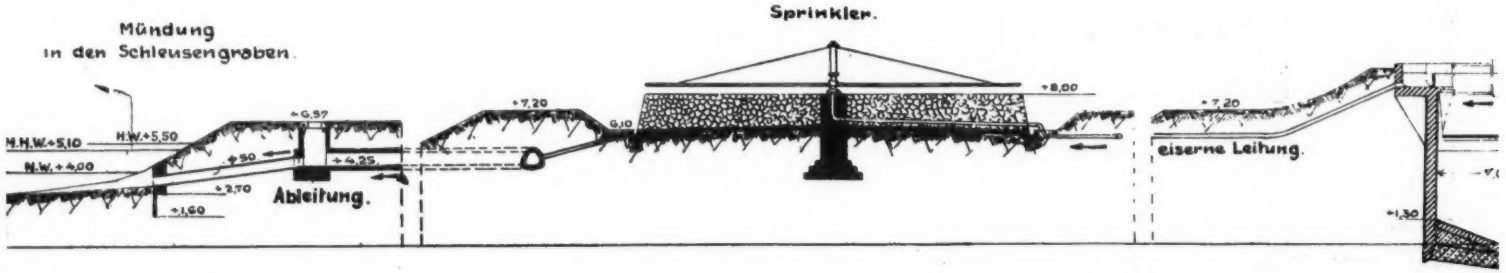
SEWAGE *enters the pump well (pumpenbrunnen) thru two pipes (zuleitung) from upper left and lower right corners, is pumped by centrifugal pumps in the pump-house (maschinenhaus) to the Imhoff tanks (Emscherbrunnen) shown on opposite page, runs thence to the sprinkling filters (sprinkler) and after passing thru them flows to the settling tank (fischteich) above and thence out by pipe (ableitung) in lower right corner.*



ONE OF THE INFLOWS *of sewage enters the plant near the lower left corner and goes thence thru the pipe shown to the pump well shown on opposite page. The Imhoff tanks (Emscherbrunnen) and sprinkling filters (sprinkler) are shown in this half of the plan. The sludge from the Imhoff tanks is drained into areas marked "schlammplatz" to dry prior to removal. Space for additional Imhoff tanks and sludge beds is shown adjoining those now installed.*



THESE TWO CUTS *show the flow of sewage thru the plant in section. The sewage enters at the right (above) thru the pipe "zuleitung," flows into the pump well (pumpenbrunnen), is thence pumped, flowing in the direction of the arrows thru the pump house to the top of the Imhoff tanks (Emscherbrunnen). Below, the sewage is shown flowing from the Imhoff tanks thru the iron pipe (Eiserne leitung) up thru the center of the sprinkler, by which it is distributed over the filter beds by the revolving horizontal arm swinging on the central bearing. From the outlet of the filters it flows thru the effluent pipe (ableitung) into the Schleusengraben ship canal and thence into the Elbe river.*



drying on sand beds 6.6 feet (2 m.) thick, with underdrains for two weeks, it was quite dry and smelled only of garden mold.

There are four sprinkling filters of the rotary type, 65.6 feet (20 m.) in diam. and 5.9 feet (1.8 m.) deep, constructed of slag obtained from the incineration of refuse. The material is very coarse, being about the size of a man's fist, with the enclosing walls of pieces perhaps 6 or 8 inches in diameter. It did not appear to be as hard as would be desirable but was no doubt less costly than broken stone and from experiments made with similar material elsewhere the local authorities believe it will remain satisfactory for a period of from 16 to 20 years.

The rotating sprinkling device, furnished by the Geiger Manufacturing Co., of Karlsruhe, consists of four perforated pipe arms suspended and receiving their supply of sewage from a central vertical shaft. Two of these arms connect with the central shaft by an upward double bend or goose-neck, of such a height as to prevent the full flow of sewage to these arms except during storms. The dry weather flow, therefore, is distributed to the filter by the other two arms with, perhaps, a small amount from the outer ends of the arms provided with goose-neck connections. By this device a better velocity is maintained in the arms, avoiding deposits, and a more uniform distribution is effected on the filter. The writer was told that up to the time visited no stoppage had occurred in these sprinklers and that no difficulty had been experienced from winter temperatures.

Flies were quite numerous on and about the filters and a large part of the organic material in the sewage is found to be converted into worms and other minute organisms. The effluent, when noted, was very clear.

From the filters the effluent flows to artificial fish ponds without passing thru the settling tanks usually provided in such plants. These ponds, which were not complete when visited, were to be stocked with carp which, it was believed, would find an excellent food supply in the worms, etc., washed from the filter.

From these ponds a 23x2.6 ft. (.70x.80 m.) conduit carries the effluent to the Schleusengraben ship canal, which leads to the Elbe. The tidal range in this canal is from elevation 13.1 (4.00 m.) to 16.7 ft. (5.10 m.), or 3.6 ft. (1.10 m). When the surface rises above elevation 19.0 ft. (5.80 m.), or 2.3 ft. (0.70 m.) above mean high water, the operation of the sprinklers is stopped and reliance placed on the Emscher tanks only.

The cost of the 8-h.p. Diesel motors was $1,430 (6,000 mk.) each, and that of the entire plant about $83,500 (350,000 mk.). The plant is so arranged that additional units can be added when required, doubling its capacity.

The writer is indebted to Baudirektor Sperber and Dipl. Ing. Keitel of Hamburg for much of the information regarding these works.

LIGHT and WATER PLANT

OF OPELOUSAS, LOUISIANA.

By A. C. Jones, Superintendent.

This rather intimate relation of the difficulties with the lighting and water works plant of a small Southern city and the methods used in removing them, is by the man responsible for the improvements after the city council saw fit to authorize the work, and shows what can be done with very little, if one has the courage of his convictions and the ability and authority to carry them into practical application. This transformation of a bankrupt institution into a dividend-payer should encourage other municipal and private plants with annual deficits to apply scientific and business principles to their reconstruction and management and pull them out of the "Slough of Despond."

THE electric light and water works plant was installed by Opelousas, La., in 1897 and as first installed consisted of one 110-horse-power center-crank McEwen engine, two 80-h.p. return tubular boilers, one 50-kw. Fort Wayne high frequency alternator, one 40-light Fort Wayne arc machine and 40 open arcs. The water works pumps consist of two 500-gallon Smith-Vaile pumps.

This equipment was kept in service for a number of years and another alternator and engine were installed and the arc machine was discarded and alternating enclosed arc lamps were put in the place of the old open arcs. This equipment gave very good service and the city was able to operate it without serious loss until about 1909, when fuel started to increase in price to a point that meant serious loss unless something was done to decrease the amount of fuel consumed. As soon as the plant started to losing more than the city could afford to lose we found ourselves unable to get enough money to keep the machinery in good repair.

About the same time, the boll weevil destroyed the cotton crop, which was the main dependence of the people round about and almost ruined the principal merchants and the business of the people generally and this ruin was also felt to a great extent in the falling off of the revenues of the light and water system. At the same time the people voted the parish dry and took the saloon business away from the plant and the saloon licenses away from the city. I spent a great many sleepless nights about this time trying to figure out some way to fix things so that we could keep the plant running without loss or with even a reasonable loss, but came to the conclusion it could not be done with a steam plant. I investigated gas producers and oil engines and came to the conclusion that the only salvation for the city was to install an oil-engine plant. I put the proposition up to the city council but could not get them to even try to do anything. Things kept going worse and worse until the mayor decided that I was to blame for not knowing how to make the steam plant pay, and he employed a consulting engineer to go to the plant when I was not there and look over conditions and report to him. The report was that all was needed was some small repairs that could be cheaply made. I was at the council meeting at which the report was made so I hit the engineer and resigned.

My successor spent $4,000 making the temporary repairs, but kept on losing money so he recommended that the city buy a new steam plant. They finally

bought a tandem-compound 4-valve Fleming engine, direct-connected to a 150-kw. 60-cycle alternator and a 250-h.p. Babcock & Wilcox boiler. This was a first class outfit and the salesman succeeded in convincing them that the fuel bills would be reduced if they put it in, but the results were not much better than they had been with the old plant. By the early part of 1911 the city finances had reached a desperate shape and it seemed that the plant would have to be shut down for good. The receipts from electric and water service were insufficient to pay the fuel bills so that it had become a regular custom to borrow money from the banks to pay for fuel. The employees had to go to the banks and borrow their salaries on their own notes and at the beginning of the next year the city council would pay these notes with interest, out of the license funds.

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¶ RADICAL CHANGES *were required by the conditions into which the plant had lapsed for need of a little money and management at the proper times.*

A new city council took charge of the city's affairs in 1912 and they realized that some radical change had to be made in the electric and water works plant. They finally succeeded in persuading me to again take charge of their plant in July, 1912, and I found things in the most deplorable condition possible. The arc lamps had all burned out and had been replaced by 100-watt Mazda lamps simply screwed into a series socket which was hung up on the old arc-lamp wires, without any attempt at a fixture of any kind. There were no lightning arresters on the wires and every time the lightning would flash it was customary to go to the telephone and see what was burned up so as to get the repairs made before dark. There were always repairs to be made after a storm. The engine and boiler were in good condition but the pumps were worn out. The meters on the electric system were found to be in fairly good condition in spite of the fact that they were 140-cycle meters and the change to 60-cycles has been made without recalibrating them or making any changes in the coils.

The first thing I did on taking charge was to buy 25 Garton-Daniels lightning arresters and put them up. I next grounded the neutral wires on all the secondaries. This cost practically nothing and entirely stopped all trouble from lightning. I was here about a month before I succeeded in getting these changes made and lost over $100 in meters and transformers in that time, and had about fifteen cases of trouble caused by blown fuses in transformers. We occasionally now have reason to know that there is such a thing as lightning, but very rarely, and we seldom lose much by it.

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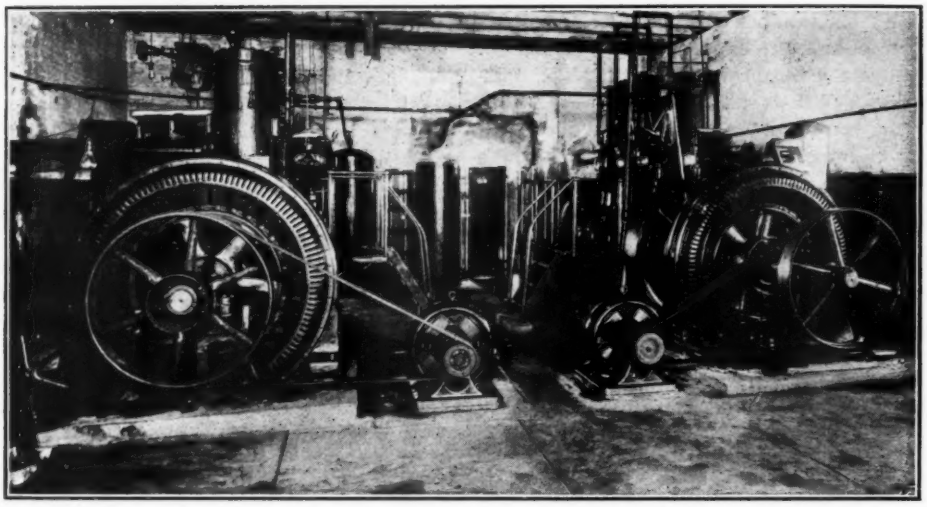
¶ HOW TO MAKE OVER *a plant without money was the problem attacked by the new superintendent.*

The city was in such a deplorable financial condition that the mayor and aldermen were almost in despair. They had to manage in some way to borrow enough money to buy fuel and and also to arrange to install the oil engine plant and the mayor has often said that he didn't know at night where he was going to be able to borrow money enough to get fuel oil to run the next night. We finally arranged to increase the tax rate three mills for two years and anticipated this revenue for two years and managed to borrow $6,000 on it. With this money we bought our first new unit, which consists of one 100-h.p. Mietz & Weiss oil engine, direct-connected to a 100-kva. Fort Wayne alternator, one generator panel, one feeder panel, one 500-gallon Lawrence pump direct-connected by a 35-h.p. 3-phase motor, one 12 by 10 Ingersoll-Rand air compressor with short belt drive from a 35-h.p. 3-phase motor. This installation cost us a little over $11,000. Since we had only $6,000 it was necessary to arrange to pay this out of the money collected from the electric and water service, so we arranged to pay $200 per month, with interest, until this was paid.

This first unit was put into regular service on December 15, 1912. It was



POWER ROOM *of light and water plant of Opelousas, Louisiana, showing Mietz oil engines and dynamos.*

not large enough to carry our peak load, so we had to run the steam plant for about three hours a night, but in spite of this our December report showed a profit of $427.82. There has never been a month since then in which we did not make a profit.

As soon as we could arrange to do so we bought our second oil-engine set, which consists of one 150-h.p. Mietz & Weiss oil engine direct-connected to one 100-kva Fort Wayne alternator, one generator panel and one 300-gallon pump, made by the Lawrence Machine Works and direct-connected to one 20-h.p. 3-phase motor. This installation was completed Jan. 1, 1914. It cost us installed $10,842.00 and left us a debt of $5,842 on this part of the plant, which was to be paid from the revenues of the plant at the rate of $250 per month with 5 per cent. interest.

We are now paying, each month, $450 with interest and in addition to this are paying all labor and operating expenses out of our collections for electric and water service and are furnishing the city in electric light and water service $321 per month in addition to this. We are giving 24-hour service practically the year round and have improved the quality of the service to such an extent that we have reconnected all of the customers who had discontinued the service on account of bad service with the steam plant. Our gross revenues average $150 per month more now than they did under old conditions, principally due to better service, as the new subscribers connected would not account for this increase.

We were somewhat afraid to buy the oil engines for the reason that we were afraid we could not depend upon them to operate the alternators in parallel satisfactorily and so in our contracts with the Mietz & Weiss Company make them guarantee satisfactory parallel operation. They didn't seem to be afraid to have this specified and so we took the chance. On this score there has never been any reason to worry because the two engines parallel very satisfactorily and frequently run together for five hours at a time. The hand-control lever of the Mietz & Weiss engine makes them very easy to get into step and we frequently put these two engines in parallel with only one man in the plant.

We are using the same number of men in the plant that we did with the steam plant. We have a day and night engineer and a night oiler. One man could do the work at night by himself but we do not consider it good policy to leave one man by himself at night when no one is likely to pass thru the plant, and then in

case of trouble two men can prevent a shut down where one can not do so. As far as the work is concerned there is not enough to keep one man busy half the time.

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¶ THE WATER WORKS *plant is an addendum to the electric light plant, very important but easily taken care of.*

The water works system is supplied with water by two motor-driven centrifugal pumps. The water in the well is 42 feet from the surface of the ground so that it is necessary to use an air lift to pump to the reservoir at the plant. This air is supplied by the motor-driven air compressor. We have not been able to find money enough to duplicate this part of the plant but plan to do so as soon as we can. From the reservoir the water is pumped by the centrifugal pumps to an elevated tank located on the court house square, about a half mile from the plant. This tank is 120 feet high and holds 80,000 gallons of water. The water consumption averages about 200,000 gallons per day, but in very dry weather is at times as much as 300,000 gallons.

The population of Opelousas is 5,111.

All water is supposed to be sold only on the meter system but it has been found unnecessary to meter all services and it has been found better to let the superintendent use his judgment as to what is best to meter. The city is not too large for him to keep a fairly close watch on the customers and prevent much waste. Whenever a customer is connected to the sewer system and he could waste much water without it being noticed, he is furnished with a meter. All meters are the property of the city and are furnished without meter rent.

The rate charged for water per 1,000 gallons is:

20 cents where 5,000 gallons per month are used.

19 cents where 10,000 gallons per month are used.

18 cents where 20,000 gallons per month are used.

17 cents where 30,000 gallons per month are used.

16 cents where 40,000 gallons per month are used.

15 cents where 50,000 gallons per month are used.

14 cents where over 50,000 gallons per month are used.

Minimum, 40 cents per month on ½-inch pipe; 50 cents on ¾-inch pipe; 75 cents on 1-inch pipe; 5 per cent. of meter cost on large sizes.

The electrical service is all on meter and the rates are as follows: 250 kw. hr. or less per month, 10 cents; minimum, 50 cents per month on 1 to 10 lights; 75 cents on 10 to 20 lights; $1 on all over 20 lights. A deposit is required sufficiently large to cover the estimated bill before service is started. There is practically no motor load connected except in summer, when the fan business is fairly good.

The December peak load is a little over 100 kilo-watts and the mid-summer peak is about 60 kilowatts.

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¶ THE FINANCIAL RESULTS *are remarkable for a plant in so small a city after a history of poor and expensive service.*

The total receipts for lighting service during the fall and winter amount to about $1,000, and the water service $400 per month. In the spring and summer they amount to $800 for light service and $400 for water service. In addition to this the city pays the plant $321 per month for the street lighting and water service they use. This money is not paid into the treasury of the electric light and water plant until the end of the year so we cannot calculate on paying any of our obligations with it, but have to meet the notes we owe on our oil engines out of our collections for electric and water service.

All meters are read during the last three days in each month and the bills rendered by the first. We use a system of making our bills which we have found works very satisfactorily and which has been copied by several of our neighboring towns. In this system the man who reads the meter enters the reading on the customer's sheet in a specially prepared book into which the last reading of the meter has already been transferred from the previous month's book. The sheet on

which he enters the reading remains in the book as a permanent record. Under this sheet are two sheets on which carbon copies are taken. The second sheet is the receipt to be given when the meter is read. All three sheets are different colors so as to prevent mistakes. When all the bills have been made out, the books are turned over to the city clerk, who is also collector. All bills are payable at the office and failure to pay by the 10th is regarded as sufficient cause for discontinuing the service.

I have gone into the details of our plant frankly and wish to state here that I do not regard our plant as an ideal plant as there are so many things that we lack, but I think that great credit is due to all of us who have been connected with the partial rehabilitation of the electric and water system of this city. Our task at first appeared impossible but we have succeeded in it and will be able after this year to add to the plant all that is necessary, and make the revenues pay for it. The oil engines have enabled us to save about $1,000 per month in operating expenses and have enabled this city to pay almost all of the debts into which the steam plant plunged them. I have done all I could to spread the gospel of the oil engine and I am glad to see that almost all of the new engines that are being installed in South Louisiana are oil engines. I believe that the day will soon come when every user of power will realize that he cannot afford to waste fuel oil by burning it under a boiler when he can save fully seven-eighths of it by getting an oil engine.

City's Proportion of Water Works Expense

The city of Madison, Wis., with the aid of the engineers of the Railroad Commission, has determined the amount which the city should pay for water and the amount which should be collected from the customers of the plant.

The city's proportion is based largely on the capacity of the plant for supplying large quantities of water in a short time (for fire purposes). The first step, therefore, was to separate the $76,840.96 of expense into the portions attributable to capacity and output. All the expenses are charged to capacity but 30 per cent. of pump labor, maintenance of services and meters; 75 per cent. of cost of steam generated; 95 per cent. of lubricants; 50 per cent. of miscellaneous station supplies and expenses; 60 per cent. of maintenance of pump equipment, and 20 per cent. of salaries of general office clerks and of office supplies and expenses, which are charged to output, and $1,580.06 for maintenance of hydrants, fountains and troughs, which is charged directly to the city. This makes 51.92 per cent. of the actual operating expense chargeable to capacity and 48.08 to output. Depreciation, taxes, and interest are distributed in the same proportion..

The Railroad Commission then determined that 49.6 per cent. of the plant was devoted to public use and 50.4 per cent. to private use, being the proportions of the plant devoted to public and private demands respectively. The $39,076.02 of expense charged to capacity was then divided in the above proportions, so that the city should pay $19,381.71 and the private consumers $19,694.31. Adding the direct charge made to the city above, makes its share $20,961.77.

The expense charged to output should be distributed in proportion to water actually used. An analysis of the water consumption showed that private consumers used 93.5 per cent. of the water and the city 6.5 per cent. Thus the $36,-184.88 of expense charged to output should be paid, $33,832.86 by the private consumers and $2,352.02 by the city.

Of the whole expense of operation, therefore, the city should pay $23,313.79 and the private consumers $53,527.17.

Actually the city paid a hydrant rental of $17,200 or $6,113.79 less than its share, and the other consumers paid $60,244.20, or $6,717.03 more than their share. Approximately 10 per cent. taken off the water rates and put on the water used for city purposes or the hydrant rentals would equalize the payments for the year analyzed. Very possibly another year the difference would be much less.

Observation indicates that the city of Madison is paying more nearly its share of the expense of operating its water works plant than the large majority of cities in this country.

REFUSE DESTRUCTOR

AT CLIFTON, BORO OF RICHMOND, NEW YORK CITY.

The new refuse destructor for the Clifton district in the Boro of Richmond, New York City, has now been in operation long enough to demonstrate that it is even more successful than the plant of the same general design which has been operated for several years in the West New Brighton district of the same boro, and this brief description, taken mainly from the latest report of the department having the destructors in charge, will serve to indicate the points of advantage in this later design.

THE boro of Richmond, of the city of New York, has added to its facilities for the disposal of garbage and refuse a new destructor furnace at Clifton. The first destructor in the boro, of the Heenan high-temperature, mixed-refuse type, was built in 1907-8 in the West New Brighton district and had a capacity of 60 tons a day. This plant was so successful that the new plant, built in 1913, is of the same type and has 90 tons capacity. The boro of Richmond occupies Staten Island, in New York Bay, and has three main groups of habitations, two of them served by the West New Brighton and Clifton plants, and a third, Tottenville, to be served by a smaller plant to be installed shortly.

The West New Brighton plant and its operating results have already been described in several articles in MUNICIPAL ENGINEERING and it is only necessary to state that its success is continuing. The five years of operation of the plant have shown its advantages and disadvantages, which are thus stated in the latest report of J. T. Fetherston, who constructed and has operated the plant until his recent promotion to the position of Commissioner of Street Cleaning in the boro of Manhattan:

"The plant was operated without complaints of nuisance in a locality where odors would certainly result in serious legal complications.

"By-products, steam and clinker, were obtained, the sale of which would decrease the cost of disposal if existing laws did not prevent their advantageous utilization, the value of the excess steam alone being estimated at $4,500 per annum.

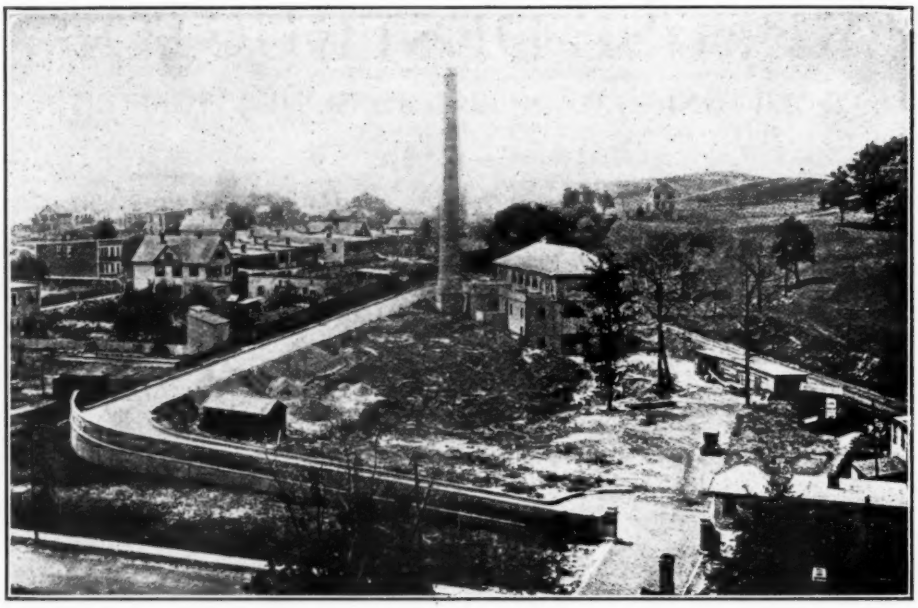
"The work of the furnacemen was very arduous and should be reduced in future installations."

In preparation for the final detailed design of the Clifton plant, and after the contract for it had been awarded to the Destructor Company in 1911, a small experimental furnace was erected to try out mechanical means of charging and clinkering the furnaces. The result is a reduction in the arduous labor heretofore attendant on those two operations and a decided reduction in the cost.

The charging of the furnace is done by a pan with a movable back or pusher, opposite each furnace door, which is forced into the furnace by a hydraulic ram so as to cover the grate completely. The pan is then withdrawn, the pusher remaining stationary, and the refuse is thus shoved onto the grate in the same relative position it occupied in the pan.

The clinker is broken up by the movement of a flat grate with two ridge bars, attached to a hydraulic ram, and allowed to drop into the cooling chamber below, from which it is pushed by another ram. The clinker falls into a bucket, where it is cooled by water and is then crushed in a roller crusher, elevated, screened and stored in hoppers for removal by carts.

There are two 45-ton furnaces in the



NEW NINETY-TON HEENAN *refuse destructor for the Clifton district, Boro of Richmond, New York City, and its surroundings, showing no fear of nuisance from its operation.*

Clifton plant with two 150-h.p. boilers, one 50-kw. electric generator, hydraulic pump, accumulator, clinker crusher, and appurtenances.

As the Clifton plant is scarcely a year old, official figures of operation for a year are not yet available, but the official tests of the plant are on record and can be compared with the earlier tests, in 1908, of the West New Brighton plant. The amount of refuse burned per square foot of grate surface per hour was nearly three times as great in the new as in the old plant, being from 139 to 147.2 pounds, as compared with 49.6 to 62.7 pounds. The residual clinker, ashes and dust is somewhat less, being 26.5 to 42.5 per cent. of the weight of the original refuse, as compared with 30.2 to 41.2 per cent. The evaporation of water in the boilers per pound of refuse burned was also less, being 1.00 to 1.11 pounds, as compared with 1.10 to 1.41 pounds in the old plant. Temperatures were slightly less, the averages in the combustion chamber being 1,657 to 1,664 degrees F. in the new plant, as compared with 1,637 to 1,846 in the old. Maximum temperatures showed more difference, being 1,830 to 1,900, as compared with 1,904 to 2,210.

Nearly twice as many fires were clinkered during the tests of the new plant as during like durations of tests in the old plant, as might be expected from the more rapid combustion in the new plant. The average time of clinkering with the mechanical apparatus of the new plant was usually about one minute, 57 to 60 seconds, tho in one test it was 3 minutes, 9 seconds. The average time of clinkering in the five tests of the old plant with hand labor varied from 8.2 to 12.3 minutes. This reduced the percentage of time the furnace doors were open from 73.7 in the old plant to 5.1 in the new.

Refuse burned amounted to 1,357 pounds per furnaceman per hour in the old plant, and 3,330 in the new, and the cents per ton in the old plant and 41 cents in the new.

During the official tests of the new plant the cost of incineration per ton of refuse burned was from 40 cents to 41.8 cents per ton. The total annual cost of incineration in the West New Brighton destructor has been from $1.23 per ton

in 1909 to $1.37 in 1912. If the difference in total cost is the same as the difference in cost of plant operation in the trial, the total cost in the new plant will be somewhat less than $1.00 a ton. If this proves to be true, the trouble and expense of experimenting with the mechanical operation of the furnace will be fully justified. Mr. Fetherston's report does not make the above definite comparison, being satisfied with the statement that "the operating cost at Clifton has been decidedly reduced, tho some time must elapse before the complete economy of the mechanical devices is demonstrated."

Another pecuniary advantage of the high-temperature mixed-refuse destructor is found in the statement that the cost of collection of mixed refuse for the West New Brighton destructor was 10 cents per capita per annum less in 1912 than was the cost of separately collected refuse and garbage in 1904, a saving of about $7,500 a year in the two districts of West New Brighton and Clifton, which Mr. Fetherston credits to the operating of the high-temperature destructor.

Municipal Ownership in Belfast, Ireland.

During the fiscal year ended March 31, 1913, the municipal gas works of Belfast, Ireland, made 2,480,628,000 cubic feet of gas, of which 1,389,231,000 cubic feet were coal gas and 1,091,397,000 cubic feet water gas. This was an increase of 142,105,000 cubic feet over 1911-12, when 1,224,282,000 cubic feet of coal gas and 1,114,241,000 cubic feet of water gas were made.

The cost of producing gas in 1912-13 was $616,219, against $633,933 in 1911-12, and the receipts from sales were $1,024,113 in 1912-13, against $971,383 in 1911-12. From the profits, $54,406 in 1913 and $54,263 in 1912 were contributed to the sinking fund of the city hall. In addition a grant of $48,665 was made each year in aid of city taxes. The following figures show the results obtained at the plant:

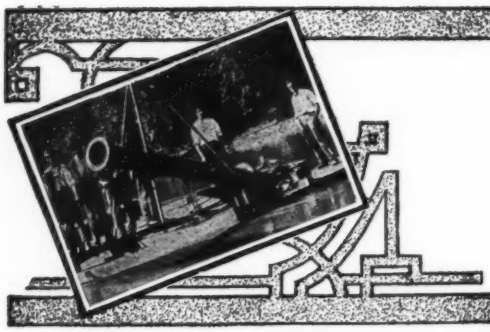
	1911-12	1912-13
Gas made per ton of coal, cubic feet	11,869	12,201
Gas made per ton of oil, cubic feet	116,211	128,001
Gas made per ton of coke, cubic feet	53,711	53,909
Oil used per 1,000 cubic feet, gallons	2,288	2,027
Works cost of gas per 1,000 cubic feet, cents	19.998	17.858
Cost of gas per 1,000 cubic feet, cents	26.738	24.502
Proft per 1,000 cubic feet, cents	14.232	16.218

The present selling price of gas is 2s. 3d. (54.7 cents) per thousand cubic feet with a discount of 20 per cent. for payment within one month from date the account is furnished. Early in 1913 new equipment, including sets of vertical retorts, a large gas holder and a coke-handling plant, was installed, increasing the maximum producing capacity of the plant from 12,140,000 cubic feet to 14,640,000 cubic feet in twenty-four hours.

During 1913 the new abattoir for the Belfast city corporation, said to be one of the most up-to-date in the United Kingdom, was formally opened and it is now in full operation. Private slaughter-houses inside the city have been abolished, but there are still a number on the outskirts. Over these the inspecting officials of the corporation have no control, tho they exercise full power of inspection over the meat brought in from them.

The water supply of Belfast is drawn from three sources, supplying daily about 23,500,000 gallons of water. The present storage capacity of reservoirs is 2,525,000,000 gallons. Plans are being drawn, however, for the construction of a reservoir that will have a storage capacity of 3,000,000,000 gallons, the estimated cost being $1,459,950.

The total income of the water commissioners for the fiscal year ended October 31, 1913, was $574,701, as against $554,241 the preceding fiscal year; the expenditures for the two years were $569,140 and $530,430, respectively.



EDITORIAL

EUROPE'S MADNESS OUR OPPORTUNITY.

Unquestionably the European war which has struck us so suddenly is the result of the rampant militarism fostered and advanced under monarchical institutions and put into action by those who still have power of life or death over their subjects at least to the extent of sending them to war. It is to be hoped that this is the death-struggle of militarism and that hereafter the economic problems of the world will be worked out without appeal to passions and prejudices. Meanwhile the people in the countries at war, willingly or unwillingly, fighting for or against the maintenance of the anachronisms in control are losing their hold upon the business of the world, and if the war continues, will find their trade gone elsewhere if any one wants it. This is due to the fault of the leaders and their inability to settle the problems of peace in a peacable way, and is the misfortune of the people.

We cannot rejoice over misfortunes but we will fail in our duty to those cut off from their usual sources of supply as well as to our own best interests if we do not step in and fill, from the wealth of our present possessions as well as the prospective product of our possibilities, the needs of those who are dependent, from the nature of their conditions, upon other nations for their supplies of manufactured products and of prepared food supplies.

In the past the manufacturers in the United States have seemed to care little for foreign trade. If it was forced upon them it was taken with pride perhaps but as a wholly fortuitous circumstance. Trade has been prevented by unwillingness to study the conditions of markets and to meet their demands and has been killed by almost criminal carelessness in handling every detail from the original letter or catalog to the collection of the bill.

On the other hand, purchasers have been encouraged in their peculiarities by traders from other countries, who humor them because they see in this a way of turning the American independence of such conditions against itself and thus preventing or killing the competition from this country.

Under war conditions the purchasers can hardly be as strenuous in their adherence to old and useless customs, and if the manufacturers of the United States will treat the trade with ordinary fairness as to quality of goods, security of packing, allowance for damage in transportation, use of agents in the countries dealt with, so as to enter into as cordial and equitable relations with it as they maintain with their customers at home, the export trade will jump at once into full growth.

The new banking system will make exchange with other countries easier. The proposed new navigation laws and aid of the government in starting the new lines of transportation made necessary by the destruction of the old, will make transfer of goods easier and less expensive. They will put American freight on vessels controlled by its friends instead of those interested in the development of freight business from other countries, thus removing large opportunities for accidents and delays for which it has been difficult to determine the causes, but which were almost always in the interest of foreign shippers.

With all the handicaps removed at once, the manufacturing interests of this country should feel immediately the impetus of the new demands and should see their trade increase by leaps and bounds. Individuals need do no more than their share in catering to the new trade, in such manner as has been suggested above, to reap their share of the golden harvest.

Municipalities and states will make their full demands and their trade is even more stable than that of private individuals and corporations, so that the readers of and advertisers in MUNICIPAL ENGINEERING should profit in more than average degree from the new conditions. This magazine has many connections with the countries whose trade with the United States is to be developed, thru correspondents, agents, and subscribers, and can and will do its full share in turning the stream of trade this way and keeping it in the new channel.

BOATS FOR THE NEW YORK BARGE CANAL.

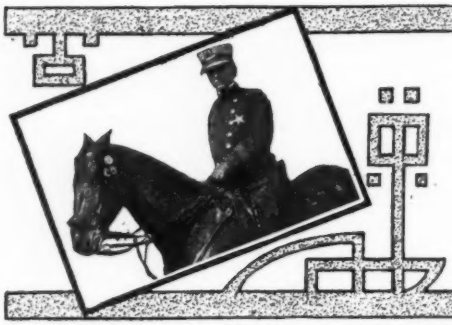
One of the problems having much influence in determining the value and the economy of a canal across the state of New York is the size of boat. This was considered in a general way during the discussion of the plans for the enlarged Erie canal, but is now up for definite solution.

A steamer satisfying Federal Government requirements for navigating the lakes cannot be designed to suit the 15½ feet clearance overhead, the 12 feet depth and 75 feet width, which are the limitations of the canal.

State Engineer Bensel suggests that the popular size will be 150 feet by 22, four in a string, as the locks will carry four, one to tow the other three. Boats 300 feet by 40 to 43 feet and 250 by 35 to 40 can be used on the lakes also, but would require passing basins on the canal, and very slow speed around curves. A 50-foot tug could tow one larger and one smaller barge in the canal and larger tugs could tow fleets of them on the lakes and Hudson river.

The state must determine the maximum sizes and prepare the canal for them before the new canal is put in full operation. Will the contention that the canal is too small for economical operation in connection with the waterways at both ends be proved correct?

A special investigation by one manufacturing firm showed it would not be desirable to tranship at any intermediate port and boats must be designed for cheap and rapid unloading at warehouses and ocean vessels. They must use the larger sizes of barges noted, with tugs, if the state will equip the canal so that they can be handled.



QUESTION DEPARTMENT

Building Ordinance for Small City

We would like to get a copy of what you consider the best building ordinance, both for fire district and for residence or wood building district, more especially fire ordinance, for a growing, up-to-date tourist town on the coast, with about 10,000 population, many apartment and rooming houses, small and large hotels and boarding houses.

N., Commissioner of Public Safety,
————, Fla.

We want to get some regulation here on buildings and I am writing you to see if you can give me any information that will enable me to write an ordinance, or can get me a sample ordinance. M., City Engineer,
————, Pa.

A recent publication of the National Board of Fire Underwriters 135 William street, New York, and the National Fire Protection Association, 87 Milk street, Boston, gives a "Code of Suggested Ordinances for Small Municipalities," including regulation of fire limits and building construction, automobile garages, picture machines and premises, inspection of premises by fire department, clearing streets of refuse, burning of refuse, storage of explosives, fireworks and fire escapes.

These forms of ordinance can be modified readily to fit local conditions and can be obtained upon request from either of the organizations named. To show the scope of the building and fire-limit ordinance the following titles of sections are given:

1. Fire Limits; defining them.
2. Permit Required; for building, enlarging, altering or moving.
3. Incombustible Walls, Cornices and Roofs Required Within Fire Limits.
4. Permissible Wooden Structures Within Fire Limits; temporary one-story, certain described one-story sheds, fences, piazzas or balconies, bay-windows, small, low outhouses, grain elevators, coal pockets, ice houses, all as described and under limitations set.
5. Repairing Frame Buildings Within Fire Limits; not permitted if fire has destroyed more than half its value, exclusive of foundation.
6. Buildings Having Prohibited Occopancies Within Fire Limits; including public garage, coffee roaster, bakery, dry-cleaning establishment unless fireproof.
7. Limits of Height and Area; to 3 stories for hollow terra cotta or concrete blocks; to 4 stories unless fireproof; to 10 stories for any building; of floor area between fire walls.
8. Walls; thickness, materials, fire walls, brick, reinforced concrete and stone walls, party walls, hollow block walls, compressive strength of blocks, lath and plaster.
9. Concrete Construction; proportions, design and construction.
10. Protection of Ends of Wooden Beams; in party or fire walls.
11. Protection of Wall Openings; in interior walls; fire doors, shutters, wired glass windows, closing of fire doors, shutters and windows.
12. Stairway and Elevator Shafts; separation, enclosures, fire doors, trap doors.
13. Skylights over Stairway and Elevator Shafts; incombustible frame and sash, glass, screen.
14. Floor Lights; glass in metal frames.
15. Light, Vent and Dumbwaiter Shafts.
16. Roof Covering; incombustible; renewal of shingle roofs damaged over 25 per cent. prohibited.
17. Roof Openings.
18. Exits Required; doorways, elevators, stairways.
19. Fire Stops.
20. Areaways.
21. Frame Buildings; not over two stories except private dwellings three; no frame building over 7,500 square feet if one-story or 5,000 if two, except grain and coal elevators and pockets, ice houses and exhibition buildings; none within 3 feet of lot line or 6 feet of another building without 2½ inches of brickwork or equal incombustible between; dividing walls in rows of incombustible material with metal lath; metal or brick veneer does not change classification as frame; brick buildings outside fire limits may be varied by permission from strict requirements of brick buildings in the ordinance.

22. Electrical Installations; according to National Electrical Code.
23. Chimneys and Fireplaces; detailed restrictions.
24. Wooden Beams Separated from Masonry Chimneys.
25. Smoke Pipes; thru or near partitions, floors or roofs, how protected.
26. Hot Air Pipes and Registers; thru floor or partitions, how protected, registers, register boxes, cold-air ducts incombustible.
27. Steam and Hot Water Pipes; not within one inch of woodwork; thru floors, ceilings or partitions protected.
28. Dry Rooms; if over 125 degrees F. must be lined with incombustible as described, with wire glass windows.
29. Stoves and Ranges; proximity to walls, shields, hoods, floor protection.
30. Heating Furnaces and Appliances.
31. Open Flame Heating Devices.
32. Gas Connections; metal pipes; portable heaters.
33. Vent Flues.
34. Safety of Design; as to loads to be carried.
35. Duties of Enforcing Officer.
36. Penalty for Violations.
37. Conflicting Ordinances Repealed.
38. Date of Effect.

The city of Indianapolis, Ind., had a new ordinance passed in November, 1913, which goes into great detail, so that the official publication of the ordinance required eight solid newspaper pages of six-point type.

Its parts each include several sections and the titles include:

1. Building Code; covering organization of office, 15 sections.
2. Definitions, 1 section.
3. Fire Limits, 1 section.
4. Preliminary Requirements; permits, fees, inspections, arbitration, bond, 16 sections.
5. Classification of Buildings, 9 sections.
6. Quality of Materials, 8 sections.
7. Loads and Floors, 5 sections.
8. Excavations, 4 sections.
9. General Conditions, going into details of construction, 48 sections.
10. Skeleton Construction, 5 sections.
11. Reinforced Concrete Construction, 43 sections.
12. Concrete Block and Massive Concrete, 14 sections.
13. Stairways, 5 sections.
14. Theaters and Places of Amusement —Classification and Construction, 77 sections.
15. Fireproof Shutters and Doors, 7 sections.
16. Chimneys, Flues and Stacks, 12 sections.
17. Furnaces and Heating Plants, 14 sections.
18. Livery and Feed Stables and Garages, 6 sections.
19. Storage of Oils, 4 sections.
20. Restricting the Manufacture and Handling of Calcium Carbide and Products Thereof, 2 sections.
21. Cellars, Water System, Rotary Nozzles—Inspection of Cellars, 7 sections.
22. Signs, Sign-Boards and Bill-Boards, 17 sections.
23. Smoke—Smoke Inspector, 8 sections.
24. Elevators, 24 sections.
25. Electric Wiring for Light, Heat and Power, 47 sections.
26. Penalties—Repeal, 3 sections.

This ordinance has much more than would be required in the small cities making the inquiries, but the general plan of the ordinance could be followed, omitting unnecessary sections.

Cleveland also has an excellent building ordinance which fills a good sized book.

Compulsory Connections With Sewers

We are about to pass an ordinance condemning all cesspools, etc., and compelling connections to be made to the city sanitary sewer, and would like to know of other towns and villages who have gone thru this and just how far they were able to enforce such an ordinance. Any references to legal decisions which you can give us will be doubly appreciated.

S., Sewer Commissioner,
————, Neb.

This is one of the first questions which arises when a sewer system is constructed and its answer depends upon local conditions almost entirely. For this reason we ask our readers to report their experiences for the benefit of the inquirer.

It is assumed that there is a public water supply. One method is to require a sewer connection from every lot on which city water is in use. This is done by ordinance, or in some cases by regulations adopted by the board of health under the general sanitary ordinance or the city charter. In larger cities connections may be required from every lot, especially if wells have become polluted and are condemned so that connections with the city water supply are forced by lack of other water.

This is done more easily if the water supply is owned by the city, such ordinances often bearing the suspicion of being passed for the benefit of the water company in case of private ownership, especially in small cities where the dangerous character of well water supplies has not yet shown itself strongly.

In one city the ordinance provision is as follows, the water supply being in the hands of a private company, well water not above suspicion but still in general

use, and the city in the process of constructing a sewer system:

"The common council, upon the completion and acceptance of any public sewer, shall direct the mayor to give thirty days' notice to the owners or tenants of all hotels, restaurants, boarding houses, drinking saloons, hospitals, or infirmaries, having a frontage on the street wherein such sewer is laid, that they will be required to make connections with such sewer, under the provisions of this ordinance. All persons who shall fail to comply with the requirements of such notice within thirty days after such notice shall be served upon them, upon conviction before the police judge shall be fined in any sum not exceeding one hundred dollars."

Another aid in inducing the making of sewer connections will be found in strict regulations of dry closets, cesspools, vaults and the like, some of which will be found in MUNICIPAL ENGINEERING, vol. xxxviii, p. 37. If these regulations are made sufficiently strict to insure perfect sanitary conditions and the cost assessed for carrying them out is made large enough to pay all the expenses, it will usually be found cheaper to use city water and put in the sewer connections, and thus the property owners or tenants will find it to their interest to make the connections.

The ordinance above quoted may be made to apply by adding residences and all producers of waste removable thru sewers to the list of buildings to which it applies. Possibly it will be necessary to add the proviso "connected with the public water supply," or "having a sufficient water supply in the opinion of the board of health." There seems to be no question that the board of health has the power to abate nuisances and charge the cost on the persons or property responsible and the only questions are as to methods. These differ according to the laws and city charters in the various states and advice should be obtained from the city attorney or others conversant with the laws of the locality as to the advisability of any certain method of procedure.

Among cities cutting off the use of cesspools on all streets as rapidly as they are supplied with sewers are the following whose methods of taking care of right soil are reported in MUNICIPAL ENGINEERING, vol. xxxv, p. 8.

Somerville, Holyoke, Springfield, Mass.; Pawtucket, Providence, R. I.; Hartford, Conn.; Hoboken, Elizabeth, N. J.; Harrisburg, Pa.; Augusta, Ga.; Seattle, Tacoma, Wash.; Los Angeles, Cal.; Milwaukee, Wis., which carries on a fairly regular campaign of condemning vaults; Albany and Troy, N. Y., the latter operating under orders of the board of health.

Not all cities have as definite powers as are conferred on the city councils of certain Indiana cities by the following charter provision, but most of them have almost equal powers under the sanitary laws of their states and the general powers granted them by legislative enactments:

"To declare what shall constitute a nuisance, to prevent the same, require its abatement, authorize the removal of the same by the proper officers, and provide for the punishment of the person or persons causing, continuing or suffering the same to exist, and to assess the expenses of its removal against such person or persons and to provide for collection of such expenses either by placing the same on tax duplicate or by suits."

Expansion Joint in Alley

Is it customary or necessary to use expansion joints in a brick pavement in an alley intersection? The alley is 16 feet wide and 26 feet long from curb line to property line. I am a graduate engineer and a paving contractor. H., ————, Ind.

The description is of an alley wing within the limits of the street which the alley enters and between the street pavement and the street property line. If this is correct, it may be said that it is customary to carry the expansion joint along the gutter of the street pavement across the alley intersection, but not to put an expansion joint in the alley wing pavement proper.

In locating expansion joints in such appurtenances to the pavement proper, insufficient attention is paid to the local conditions and so their success from the point of view of the prevention of expansion is problematic.

Altho traffic must cross thru the gutter in passing from the street into the alley, the gutter is preferable to a crowning of the alley pavement so as to meet the crown of the street pavement, because this crowning of the junction of alley and street inserts a weakness in the line of the longitudinal expansion of the street and may cause bulging of the street at the alley intersection in the same way as that occurring at street intersections which are not properly designed.

Usually it is desirable to pave alleys lower in the center than at the sides rather than to crown them, as this carries the drainage in one line to the street gutter and without special preparation of gutters for the alley. This makes it easy to flatten out the cross section of the alley to meet the fixed straight line of the street gutter.

The expansion tendency of the alley pavement is thus prevented from bulging that pavement and longitudinal expansion joints are not necessary in an alley or street paved with such a cross section.

Any slight expansion in the 8 feet of the half alley width is resisted by the material of the pavement itself or pushes the margin of the pavement out slightly.

This method of construction is likely to produce a step down on each side from the sidewalk to the alley surface, which may be reduced by carrying the alley pavement out as high as possible to a point near the street gutter and then dropping its surface by as steep a grade as is practicable to the level of the street gutter. This produces a rather objectionable depth of gutter for traffic to pass across in going from street into alley and an adjustment of demands should be made so as to make the surface as satisfactory as possible. At the change of longitudinal grade of the alley which is likely to take place either at the edge of this gutter or at the property line of the street, there is an opportunity for longitudinal expansion to produce a bulge in the alley pavement. If this change in longitudinal grade takes place where the cross-section of the alley is concave upward, the conditions are rather complicated and it is probable that no expansion joint would be needed. If it takes place where the alley cross-section has been flattened out, bulging is liable to occur. The writer is disposed to think that an expansion joint in the alley intersection or at the property line is not the cure for this tendency to bulge, but that it might tend to emphasize it. A better safeguard would be a heavy marginal curb, deep enough and strong enough to prevent the expansion and cause it to be taken up by internal stresses in the pavement itself.

Who Design and Build Electric Lighted Fountains?

This city has under contract, under my direction, the construction of a lakeside public park, including shell walks and roads, public comfort stations, drinking fountains and ornamental water fountains, among which latter is proposed a large reinforced prismatic fountain, electrically illuminated. This fountain will consist of a large pool or basin approximately 75 feet in diameter, several centrally located superimposed basins, surmounted by a fountain head and 6 or 8 smaller fountain heads arranged in the large pool.

So far I have been unable to get any data on the design of a fountain of such magnitude, especially on the feature of the prismatic illumination by electricity, and I would therefore appreciate your assistance or suggestion in the matter of design, covering the construction of the above described fountain.

B.

Can our readers refer our correspondent to designers or manufacturers of such fountains? Application to the management of the great expositions, especially at the present time to the superintendents of construction of the Panama-Pacific Exposition at San Francisco and the Panama-California at San Diego should put the inquirer in touch with experts in this line, as both will use them.

Rates for Public Utility Services

Will you kindly furnish me with information, pro and con, in regard to public utility companies' rates.

B., Mayor,
———, N. C.

The "Manual of American Water Works" ($1.50) for 1897, gave a full table of rates for private and public water service, which is of course somewhat out of date as to many cities. The most comprehensive recent list is in the Journal of the American Water Works Association, 2419 Greenmount Ave., Baltimore, Md.

Electric light and gas rates are given in more or less detail in Brown's Annual Directory of American Gas Companies ($5) and McGraw's quarterly "Electrical Directory" ($10 a year).

Trigonometric Tables of Grads

I want to find out if possible where I can obtain tables of natural and logarithmic sines, cosines and tangents of grads (400 grads = 360 degrees).

L., ———, Conn.

If the writer's memory is not at fault such a book dividing the quadrant into 100 parts in conformity with the metric system was printed in France many years ago and can possibly be obtained thru importers, such as D. Van Nostrand Co., or G. E. Stechert, New York. During the present difficulty of communication with European countries, possibly some reader can locate a copy of the tables in this country that can be obtained by our correspondent.

Unloading Tank Cars of Road Bitumens

Can I get from you a circular describing the unloading devices for unloading tarvia and oils from tank cars into wagon tanks, or tell me where I can get information.

H., ———, Ariz.

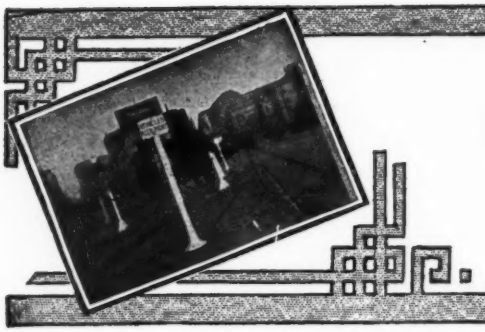
There is no regular manufacturer of such apparatus known to the writer. An illustrated article on the subject is in preparation but is not ready to appear in this number of MUNICIPAL ENGINEERING.

Makers of Metal Street Signs

Will you give us the names of manufacturers of metal signs for street names and to limit speed of automobiles?

R., ———, Pa.

The Curtis-Ward Co., 28 E Jackson St., and the Enameled Steel Sign Co., 222 N State St., both in Chicago, Ill., are makers of such signs.



WORKERS IN THE FIELD

Burned Asphalt Quite Unnecessary

The Editor of MUNICIPAL ENGINEERING:

Sir—I have read with much interest the articles under the heading "Burned Asphalt Can Be Prevented," on page 49 of your July issue, and page 125 of your August issue. Apparently the article in the July issue was written by someone interested in the building of asphalt paving plants of a special type providing for steam heating the asphalt cement. The name of the writer is not given. The article makes a statement to the effect that with steam at 125 pounds pressure the asphalt cannot exceed 350 degrees. This statement is absolutely true. Mr. Hetherington, who is interested in another type of asphalt paving plant, picks this up and says: "But the real question is this: Can you obtain 350 degrees of temperature from steam at 125 pounds pressure without outside assistance from another source of heat?" and adds: "The Fahrenheit temperature of steam at a boiler pressure of 125.3 pounds is 352.8 degrees. Inasmuch as it is a well-known fact that a very considerable percentage of loss is occasioned between the boiler and the melting kettle, it is difficult to understand how you can obtain 350 degrees temperature in your asphaltic cement from steam at 125 pounds boiler pressure."

This statement is also doubtless technically true, but practically it is not at all necessary to heat true asphalt cement to 350 degrees Fahrenheit. While high-grade asphalts are not injured at 350 degrees, it is safer not to heat them above 300 or 325 degrees Fahrenheit, a temperature which certainly can be attained by steam heat.

The writer of the earlier article says: "All asphalt coming in contact with the part of the melting kettle nearest the fire is burned in spite of any agitation given it." Mr. Hetherington picks this up and, without stating that the alternatives which he suggests are those adopted by him in his special form of asphalt plant construction, says that the trouble can be overcome by either:

1. "Asphalt melting kettles have been superimposed over the settings of sand heaters in such manner that the surplus heat from the fires of the sand heaters acted upon the shells of the kettles from below and thus formed heating means auxiliary to steam melting coils arranged upon the insides of the kettles."

The serious objection to this method is that it is a complicated construction, not only making it extremely difficult to make repairs to either kettles or sand heaters, but also increases the expense of operation and the danger of serious fire when the time comes, as it always will come sooner or later, that the kettle leaks; also, if the asphalt cement in the kettle becomes too hot it is liable to further injury from the heat of the dryer fire, which cannot be shut off without closing down the entire plant.

2. "Separate the fires from the kettles by interposing walls so that burning of the asphaltic material is practically impossible if the melting operations are under the charge of an ordinary intelligent operative."

The objection to this method of construction is that it is unnecessarily complicated and expensive and does not allow the kettle to utilize the heat from the fire to the fullest extent.

Referring further to the statement quoted above by the writer of the article in your July issue to the effect that, if the bottoms of the melting kettles are subjected to direct heat or, as he expresses it, "with furnace heat applied to the exterior of the kettle at a temperature of at least 1200° F.," the asphalt cement is necessarily burned—that is absolute "buncombe."

The above statement is very misleading. Of course, it means that the temperature of the furnace flames or gases is "at least 1200° F." but as written would lead the average layman to believe that the metal of the kettle bottom was that hot, which, of course, is impossible, unless the kettles have been allowed to collect an abnormal coating of sediment and coke.

It is safe to say that as long as any liquid asphalt cement can reach the kettle

bottom the metal is never more than 20° F. hotter than the asphalt cement at top of the kettle.

Far hotter fires are regularly used under the ordinary stationary steam boiler than under any asphalt kettle, yet no one would suggest that the water in any part of the boiler approximated 1200° F.

The writer has had practical experience for more than thirty years in the handling of refined asphalts and asphalt cements in the laying of asphalt and other bituminous pavements, in all departments, from foreman of an asphalt refinery and asphalt paving plant up. He can show pavements, still in good condition, under unusually favorable physical conditions of use, having required remarkably little repairs, laid as far back as thirty years, particularly Alexander street in the city of Rochester, N. Y., in connection with which he was foreman of the paving plant. He has had direct charge of the laying of millions of square yards of asphalt and other bituminous pavements under all conceivable traffic and climatic conditions, varying from Canada to Texas. While he has operated paving plants, the kettles of which were provided with steam heating coils, and also with the devices described by Mr. Hetherington, the great bulk of the work referred to has been done with plants in which the fire (whether wood, coal, natural gas, or oil) comes in contact with the kettle bottom and he has never been able to observe that, with reasonable care, there has been practically any more trouble from overheating the asphalt cement by one method of heating than another. He can certify that, with reasonable care, it is a very extraordinary thing to injure asphalt in the process of melting. Without the exercise of due care the asphalt may be over-heated by either of the methods described by Mr. Hetherington.

It is not even technically true that "asphalt coming in contact with the part of the kettle nearest the fire is burned." It is, however, a fact that the impurities in an asphalt, if any, will, to a greater or less extent, settle to the bottom of the kettle and, to a slight extent, become coked to the kettle bottom without injuring the asphalt cement. Under such conditions, when a kettle is emptied and cleaned, it is found that there is coke to the extent of possibly one-quarter inch or more on the kettle bottom next to the fire. The fact is, that, with reasonable care with any of the accepted methods of heat application to asphalt kettles, there is no more danger of over-heating asphalt than there is of burning potatoes when boiled in the ordinary vegetable pot. If the cook permits the water to boil away, the potatoes next to the bottom quickly burn. In the melting of asphalt cement, as soon as the material next to the kettle bottom becomes fluid and hotter than the material above it, it has a lower specific gravity than the cooler material, naturally rises and produces a circulation in the asphalt cement, the cooler material taking the place of the hotter material which has risen, just as in a case of heating water. So in the heating of asphalt; so long as the material is not heated to a temperature approaching that at which the lightest of the component oils are vaporized, the asphalt is not being injured, provided it is not kept hot for an unduly long period. Of course, the circulation should be increased by artificial agitation either by steam, air or mechanical means, but this agitation is for the purpose of:

1. Retarding the settlement of foreign mineral matter to the bottom of the kettle.
2. Facilitating the melting and heating up the lumps of cooler asphalt, which is much more rapid under artificial agitation than if left entirely to circulation by gravity referred to above.
3. Facilitating the combining of the refined asphalt with the fluxing agent, which is generally placed in the kettle at the same time as the refined asphalt. As soon as the asphalt is melted and the fluxing agent and refined asphalt are combined, it is desirable to suspend agitation, unless the asphalt is of a character which contains such a large percentage of mineral matter as to require continued agitation to prevent excessive settlement.

Quoting from Mr. Hetherington: "There is no more reason why the asphalt should be burned than there is that the water should be permitted to get too low and the boiler explode" and that without the adoption of the special devices of this or that plant manufacturer which have practical disadvantages far outweighing the actual advantages produced by such devices.

It happens, with entirely too great frequency, that men who have practical experience in the different branches of the asphalt producing and paving field and who are, therefore, "experts," make public references as "advantages" to certain characteristics contained in the materials in which they are interested, or certain devices which they have adopted, which are really nothing more than commercial talking points and should not be presented to the public in the form of references of "experts" to important characteristics. Would that such practical experts would confine their public expert utterances to points of real practical importance and withhold their commercial propositions for commercial argument and not present them as free expert testimony for public consumption.

GEORGE C. WARREN.
Boston, Mass.

Philadelphia's Second Clean-Up Week

The Editor of MUNICIPAL ENGINEERING:

Sir:—Believing that you might be interested in the operation and the results of Philadelphia's second annual clean-up week, I present a comprehensive report on the preliminary advertising and the results obtained.

In conducting Philadelphia's second annual clean-up week, April 20 to 25, this year, a committee of three men, representing the Bureau of Highways, the Bureau of Fire and the Bureau of Health, was appointed by the mayor to take charge of the work done under the supervision of the city officers.

The members of this committee were: Mr. John Neeson, Assistant Engineer of Bridges and Sewers, Bureau of Highways, (Chairman); Mr. Joseph Mallory, Fire Marshal, Bureau of Fire, and Mr. R. Robinson Barrett, Chief Inspector of Nuisances, Bureau of Health.

Shortly after the appointment of this committee, the Chamber of Commerce and the Merchants' and Manufacturers' Association of Philadelphia ,appointed a large representative committee of citizens, to cooperate with the city committee in order to conduct a successful campaign. This committee was divided into twelve sub-committees, to-wit: Finance, press, poster and printed matter, trade associations, community associations, charitable and benevolent, school and school children, churches, retail stores, street cars, vacant lots and fire prevention.

Persons on this citizen's committee are all prominent business men and men interested in civic activity in Philadelphia.

In order that every citizen might know the date and the object of clean-up week, and in order that they might give their best cooperation, a very extensive and most effective advertising campaign was entered into.

The director of the Department of Public Works sent out 3,400 personal communications to the following:

(a) All advertisers and advertising agencies, manufacturers of brushes, brooms, buckets, vacuum cleaners, and, in fact, to every concern manufacturing any kind of an article used for cleaning.

(b) All women's civic organizations; civic club, home and school league, literary, etc.

(c) All business men's organizations.

(d) All theater managers.

(e) Managers of moving picture houses.

(f) All real estate agents.

(g) All banks and trust companies.

(h) Boards of Trade.

Two large placards, announcing clean-up week, were posted on the windows in each street car operating in the city. On the back of this placard a silhouette of William Penn attracted the attention of the public, so that upon entering the street car, most persons, having their curiosity aroused, immediately proceeded to read the news on the side of the poster inside the car.

The same placard was distributed to schools, libraries, clubs, lodges, commercial and industrial establishments and railroad companies, with the request that they be posted in a prominent place.

Seven hundred and fifty thousand gummed labels, suitable for attaching to envelopes, packages carried through the mail and delivered by the department stores, were distributed to all public service corporations, department stores, newspapers, banks and trust companies. These gummed labels were very attractive and were found to be a most effective means of advertising.

Two hundred and sixty thousand four-page bulletins were distributed by the police at each home. These bulletins were not simply thrown upon the porch, but were handed to each householder, so that they could not help but learn the message it conveyed. This bulletin was so designed that the back could be used to notify the city waste collectors wherever there was rubbish to be moved. This bulletin contained many suggestions and means by which the citizens might cooperate with the city officials.

Twenty thousand colored display placards were distributed to the department stores and all retail merchants in the city of Philadelphia. These were posted in prominent places in all of the large show windows. Because of the artistic coloring and the simplicity of this placard, it made a very attractive window show card and was very popular. Much larger posters, but similar in design, were posted on all the bill boards in Philadelphia. Many of these same posters were used on hauling wagons and automobile trucks.

Seven hundred and fifty streamers, two feet by three feet, with the words, "Clean-Up Week, April 20 to 25," were given to the industrial and commercial institutions in the city and were used extensively on the harness of the horses of delivery wagons and in some instances tacked on the side of the wagons. Some of these were plain white with black lettering and others yellow with blue lettering.

One million yellow cardboard folders were printed and distributed to all retail dealers, Union headquarters, lodges, clubs, social centers, public service corporations, department stores, etc., with the request that they be sent out in packages delivered and in all envelopes containing monthly statements.

Three hundred thousand badges and

three hundred thousand blotters, containing information regarding clean-up week, were distributed to the public and parochial schools.

Three hundred and fifty thousand circulars were distributed to the policy holders of the Metropolitan Life Insurance Company, requesting their cooperation in Philadelphia's clean-up week. (Thru the cooperation of the insurance company.)

Several colored slides, indicative of the spirit of Clean-up week, and containing information regarding same, were made up and sent to the moving picture theaters, of which there are 205 in the city. It is estimated that 700,000 people attend moving picture performances daily and there is no doubt in our minds that this was one of our most effective means of advertising.

Programs, leaflets, circulars, etc., were used by the theaters and moving picture houses. A number of the commercial interests in the city took advantage of the spirit of clean-up week and advertised their wares and commodities, useful for clean-up week.

Bulletins of various organizations thruout the city, such as the City Club, Civic Club, Business Men's Association, etc., devoted a great deal of space to clean-up week. Many of these organizations prepared letters and circulars of their own which they distributed among their members.

Return postal cards were sent to the owners of all insanitary vacant lots, urging them to both clean and beautify their properties. Over six hundred of these cards were sent out.

In addition, a very extensive newspaper campaign was carried on, which reached its climax in the issues of Sunday, April 19th, immediately prior to clean-up week. Articles by prominent men from all walks of life, commending the clean-up week spirit, were printed in all the morning papers. Leading up to clean-up week, practically every morning articles appeared relative to some new step made by the committee, and in this way the interest of the public was gradually aroused and their cooperation obtained.

Clergymen, in addressing their congregations on Sunday, April 19th, requested the cooperation of their parishoners in the endeavor to make Philadelphia "spick and span."

Many neighborhood contests were instituted and prizes were offered to the boys and girls doing the best work during clean-up week. Garden contests were encouraged and the use of vacant lots for garden purposes was heartily endorsed by the combined committee.

Many addresses and lectures were given by members of the clean-up week committee and city officials, instructing the citizens of the advantage to be gained thru clean-up week.

In all the advertising matter which was displayed, the householders were advised of the fact that the city would remove all the waste accumulated in the grand cleaning up. They were advised that this material would be collected on the days of the regular ash and waste collections. Arrangements were made with all the contractors collecting waste and ashes in Philadelphia, to put on many hundred additional teams to take care of the excess material during this week. Special teams were arranged to remove material where it was accumulated on vacant lots. All of the municipal buildings were given a thoro cleaning and all the offices and desks of the employes were cleaned out. A great number of department stores, public service corporations, etc., also issued orders to their employes along the same line.

The city painted most of the fire plugs during this week and the United Gas Improvement Company repainted their lamp posts. Wherever we could not secure the cooperation of the property owners in cleaning up vacant lots, the division of sanitation of the Bureau of Health issued mandatory orders upon the owners. If these orders were not complied with, the work was done by the city and the properties liened in accordance with the Acts of Assembly.

Arrangements were made for extra dumps in all parts of the city, to temporarily take care of the excess material. The material collected on these temporary dumps was subsequently removed to the city's authorized disposal stations.

Of course, the whole campaign depended upon the cooperation of the citizens, it being their duty to thoroly clean out their own premises and put the waste material at a place readily accessible to the city waste and ash collector for removal.

The response of the citizens to the call issued for their cooperation during clean-up week exceeded all expectations. There seemed to be no particular class distinction between the persons cooperating with the city in its campaign. In every locality, tremendous amounts of waste and rubbish were placed out for collection. All old material which had accumulated thruout the winter in the attics and cellars and about the house, such as old beds, frames, springs, mattresses, broken bottles, glass, chinaware and crockery, broken chairs, tables, benches, bureaus, washstands, rockers, old carpets, rags, decayed wood, tins cans, plaster, great quantities of ashes, straw hats and a great number of Christmas trees which had probably been about the house and yard since the holiday season. In fact, every thing from a tin can to old

and dilapidated grand pianos, were removed by the city waste collectors.

In many sections of the city so much material was accumulated in the houses and put out for collection that sufficient receptacles could not be obtained and material overflowed into the highways. In these cases it was necessary for the city to obtain extra help in shoveling paper and waste into wagons.

Over five hundred lots were cleaned up and placed in a sanitary condition.

The Clean-Up Week movement received such a tremendous impetus that it was impossible to complete the cleaning up dring the week of April 20th to 25th, and, accordingly, the movement was continued during the following week.

I wish particularly to commend the activity of the Philadelphia Boy Scouts in all sections of the city. Many vacant lots and yards and other properties were cleaned up thru their activity. Before the campaign started, schedules were arranged so that their work could be carried out in systematic order. Many of the local business men's associations conducted campaigns of their own in their respective localities. Members entered into the movement with great enthusiasm. In some places they did the actual physical labor themselves. It was not an uncommon sight in any part of the city to see the business men, women, girls and boys working together, the men with their coats off and their sleeves roled up.

It is estimated that during Clean-Up Week over 135,000 cubic yards of waste material were collected. This material, if placed on a city lot three hundred feet by three hundred feet, would fill it to a depth of approximately forty feet, or the top of a three-story building.

Altho Philadelphia's clean-up weeks have not been in existence a sufficient length of time to make a perceptible effect upon the death rate and fire rate of the city, we have all reasons to believe that if these annual institutions continue with the success they have during the past two years, Philadelphia will be the cleanest, most healthful and the safest city in the United States.

R. Robinson Barrett,
Chief Inspector of Nuisances, Division of Sanitation, Bureau of Health, Philadelphia, Pa.

Care of Sewage Disposal Plants

The Editor of Municipal Engineering:

Sir—Municipal sewage disposal plants are often condemned, not always because of their inefficiency, but because, when installed, they have been turned over to inexperienced men, and have not received intelligent care. This is especially true with small municipalities, where the care of a newly constructed sewage disposal plant is often turned over to the street superintendent or village constable.

A properly designed plant requires very little attention, so that after awhile it is taken for granted that it can be left to take care of itself. This is fatal, because while the plant may not need much attention, to operate successfully it must have the little it does need.

Then, again, new connections with the sewers are being made from time to time; a plant is built for a specific daily flow of sewage, and, while it has a considerable margin of safety both ways, it rarely happens that the man in charge is sufficiently familiar with its technicalities to know when it is being overloaded. Complaints are made to the municipal authorities, who probably know even less about the plant than the man in charge, and the plant is condemned.

I know an instance where a septic tank and contact beds were designed and installed for 25,000 gallons of sewage daily. The first year or so, people knowing nothing of its source were actually drinking the effluent. In the meantime, connections were added until in the course of a few years 400,000 gallons of sewage were passing through the plant daily. It had received no attention whatever, complaints were being made, and it is hard to make a great many of the inhabitants of that village believe anything but that the septic tank is a total failure.

On the other hand, if a plant is correctly designed and receives intelligent care, its efficiency is remarkable. At a point where every drop of water used had to be hauled something over 100 miles, I installed a plant in 1906-7 consisting of septic tanks, contact beds and a pair of auxiliary filters. From the filters the effluent passes into a sump, from which it is pumped back to the power plant and used for locomotive and stationary boilers. Aside from being the best boiler water he had ever seen, the superintendent in charge of the plant recently advised me that the care of the entire plant, pumps and all, did not occupy more than twenty minutes of his time each day, and that a saving of $2,000 per month had been effected by using the effluent for boiler purposes, thereby reducing the cost of hauling water, from the time the plant was built until the present time, a period of seven years; in all that time the tanks had never been cleaned out, and the effluent is as good today as ever.

These are extreme cases, but they serve to illustrate the point I am trying to make, i. e., that a perfectly good plant may be condemned for lack of intelligent care.

If a plant is improperly designed, it very soon becomes a nuisance, and no amount of care is going to help matters. Unfortunately, there are hundreds of such plants in existence.

The great trouble has been that many engineers with but little knowledge of the fundamental principles of the septic process have undertaken to design septic tanks. This lack of knowledge, coupled with the natural desire to make a low figure in order to secure business, and the tendency on the part of city and town officials to be influenced by cost rather than efficiency, has led to the designing and installing of plants under the name of septic tanks in which it was impossible for the septic process to be developed to the stage of efficiency.

Another thing which has tended to produce these unfortunate results has been the widespread belief on the part of the engineering profession that the Cameron patent related to the apparatus for developing the septic process instead of the process itself, and in their efforts to evade what they understood to be the Cameron patent, the design of the apparatus, or septic tank, has been so modified that its efficiency is sacrificed. Their failure to fully understand the underlying principles of the septic process prevented their seeing that the modifications they felt it necessary to make in the apparatus, in order to evade the patent, destroyed its usefulness.

The deplorable part of this whole matter is that many municipalities, large and small, have been saddled with systems of sewage disposal which, in some cases at least, have proved to be an absolute menace to the health of the community, while the money invested in them has been largely wasted, because such plants can only be made to perform their proper functions by either replacing them entirely, or by making radical changes in their design at considerable expense.

These results are not at all surprising when the entire situation is understood in all its details, but it serves to emphasize the fact that municipal authorities in a matter of such vital importance to the communities they represent should exercise greater care in the selection of those retained to advise them in such matters, and, profiting by the experiences of the past, make careful inquiry as to the success or failure of plants already installed by engineers who are under consideration with respect to contemplated improvements of this nature.

Moreover, arrangements could very properly be made so that, when a plant is completed, it shall be operated under the general supervision of the designing engineer for a period of years. Such provision would be some measure of assurance to the municipality, while the engineer would probably hesitate to accept this responsibility unless he felt confident that the plant he proposed to install would do all he claimed for it and be no discredit to him professionally. It must not be lost sight of that there are many engineers, who, while entirely qualified to lay out a system of sewers, may not be so well qualified to design a system of sewage disposal, which is really a separate and distinct branch of sanitary engineering.

H. D. WYLLIE,
Chicago, Ill.

Buckling of New Brick Pavement at Elmira, N. Y.

The Editor of MUNICIPAL ENGINEERING:

Sir—MUNICIPAL ENGINEERING for July contained, on page 50, an article by John T. Calkins, relating to the buckling of a new brick pavement on Church street, in the city of Elmira, N. Y.

We have been at some pains to inquire into this matter, as the buckling of any kind of brick pavement is unusual. We ascertain that the pavement was repressed brick. The grouting appears to have been good. The blow-up was due primarily to expansion, of course, but a contributory cause may be found in the break in the grade at the crown intersection of Church street with Foster street, the point at which the blow-up occurred.

The respective grades are plus 1.58 and plus 0.5, a total change of about 1 per cent., according to information given us by the State Highway Department, which supervised the work.

Thurber A. Brown, assistant, and acting, city engineer of Elmira, writes us that the pavement is 36 feet wide between curbs and 66 feet wide at the intersection. The buckling occurred about half way between the ends of the pavement.

No break occurred except at this point, altho a heave of about 1 inch occurred in the gutter 35 feet west of the break.

The gutter is continuous crossing the intersection, and at the intersection expansion joints are against the headers of the intersecting streets. The cross-street (Foster) is a dirt street, and the pavement is laid only to the street lines of Church street, with a crown of ¼-inch to the foot.

The break occurred on the section bounded by the curb lines of Church street, and transversely of the street, the extremes of the break being defined by the extension of the intersection, upon which the brick were laid longitudinally —that is to say, at right angles with the brick in the pavement proper.

The slab upheaved on the east grade (the 1.58 per cent.) was 2.60 feet wide, and the slab upheaved on the west grade (the 0.5 per cent) was 1.60 feet wide at the end of the break where the slabs did not break up.

At the other end of the break, where a crushing effect was produced and the slabs were somewhat broken up into integral bricks, the push seemed to be from the east side, as heavy sections of the west side slab were thrust back upon the pavement the width of two bricks, as shown in the photograph taken immediately after the blow-up.

The circumstance that the pavement had no cross expansion joints has been seized upon by advocates of that system as proof of the validity of their contentions, and the city council has forced the State Highway Department to use cross joints in new work. Practical paving men know by experience that transverse joints are a positive detriment to brick pavements, but it is so difficult to root from some minds an idea inherited from an era of error that it is hardly worth while to adduce arguments or cite facts in disproof of the theory that cross expansion joints are more useful than harmful.

Street intersections usually are the weakest places in a brick pavement, especially if the lateral thrust of expansion is against an elevated paved crossing. The weakness is increased if a break in grade occurs at a crown intersection, as in that case there is unequal distribution of resistance to the thrust of expansion.

Whatever may have been the efficient cause of the blow-up at Elmira, the case is unusual. It does not constitute a true bill of indictment against the efficiency of longitudinal joints. Extending easterly from Conneaut, Ohio, to the Pennsylvania state line, on the main highway which runs from New York to Chicago, is a grouted brick pavement which was laid six years ago and still is in perfect condition, altho the traffic over this road is perhaps as great as over any other highway in the United States. The only repairs ever put on the pavement were on a short section where, at the line of the only cross-expansion joint in the entire pavement, a bad blow-up occurred three years ago. Let one blow-up offset the other; but it is hardly reasonable to generalize from either particular instance.

The erroneous assumption that whereas longitudinal expansion joints cause blow-ups, transverse joints avert the same, is disproved by the fact that altho during the past four years 2,750,000 square yards of wire-cut-lug brick have been laid with cement grout filler and, with the exception of a very small percentage, with no cross joints, not a single instance of a blow-up or buckling of any kind, has been reported against that type of brick. If a blow-up ever does occur with this brick, it will be where a transverse joint has been put in despite our vigorous protest, or on account of defective grouting.

Generally speaking, engineers believe that buckling usually results from the yielding of a weak bond under stress of expansion due to thermal influences. The fact that there is no recorded instance of a wire-cut-lug brick pavement having buckled, proves conclusively that a strong bond, aided by a longitudinal expansion joint, is able to withstand the ultimate force exerted by the expansion of a pavement.

If the Elmira incident was due to failure of bond, doubtless it was because the smooth surface of the repressed brick did not afford the bonding material strong grip, so that the filler broke away from the brick. This supposition is purely theoretical, of course, as the upheaved brick had been removed from the street before our representative visited Elmira; but the theory is tenable, in view of the tendency of grout to cleave away from a smooth-surface brick under strain.

The fact that a wire-cut-lug brick pavement has never been known to buckle is attributed to the uniform lugs and beveled ends of the brick, which allow free flow of the bonding material, and the rough contact surface of the brick, which assures a structural union between grout and brick.

Our object in writing you at so great length is to show the singularity of the Elmira blow-up and to assure you that wire-cut-lug brick was not involved in the matter, nor is it likely to be involved in any such catastrophe in future if it is properly put down.

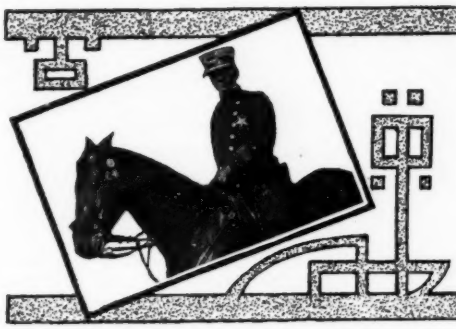
THE DUNN WIRE-CUT-LUG BRICK CO.

A Tin Smelter Needed

The high price of tin since the war began is not due to cutting off production of tin ores in the countries engaged, but to the difficulties of transportation and the location of tin smelters only in those countries.

A tin smelter in this country, say the revival of the one formerly in Bayonne, N. J., and American lines of transportation to South American and other deposits of tin ore, would relieve the situation. The Bayonne plant was ruined by the heavy export duty put on Malayan tin ores by the British government. Transportation for ores closer home is what is now needed.

Tin prices have been fixed in London heretofore. Independence of the London markets can be achieved if American manufactures and American transportation lines will step into the breach promptly.



LEGAL DECISIONS

Decisions of the Higher Courts of Interest to Municipalities

City Must Pay for Trees Removed—Where a municipality, in changing the grade of a sidewalk of the street upon which plaintiff's property abutted, unnecessarily removed shade trees, the removal being without legal justification, the municipality is liable for all damages suffered. Worth v. Town of Westfield, (N. J.) 90 Atl., 727.

Selection of Patented Material for Pavement is Legal.—Under Rev. St. 1909, Sec. 9619, relating to cities of less than 30,000 inhabitants incorporated under a special charter, contracts for street improvements are required to be let to the lowest and best bidder; but it is not a violation of such provision that there is a patented article or one held in monopoly which in the eye of the authorities is of such exceptional value that it would be a public injury to be deprived of it. Where a city council is by law invested with authority to prescribe the character of a proposed street improvement, its action in good faith in selecting a patented material controlled by a monopoly cannot be impugned on the ground that such material in fact possesses no points of superiority over others used for the same purpose. Evidence that patented concrete selected by a city council for a street improvement was not superior to the ordinary concrete, which was less expensive, did not show bad faith on the part of the city council, since there is much difference of opinion regarding the kind and character of material for paving streets and much discretion must be left to the council. It was not improper for a city council to give consideration to the request of a majority of the property owners that a particular kind of concrete be used in the street improvement, where such material was not selected arbitrarily in obedience to such request, but only after the councilmen had convinced themselves that such concrete was a meritorious article. Meek et ux. v. City of Chillicothe (Mo.) 167 S. W., 1139.

Village Liable for Hydrant Rental Beyond Contract Period if Used.—A village authorized by Village Law (Consol. Laws, c. 64) Sec. 220, to contract for the supplying of water to it for the extinguishment of fires, etc., was liable on an implied contract for hydrant rental at the date previously paid, where, after a demand of the water company for a higher rate had been rejected by the taxpayers, the hydrants were used by the local incorporated fire company. Marlboro Water Works Co. v. Village of Marlboro (N. Y.) 148 N. Y. Supp., 374.

Town Cannot Transgress Law Fixing Limit of Funds for Water Rental.—In a suit to recover rents of $900 a year for a water supply for a town, under a contract for the purchase or leasing of such water supply, where such sum exceeds the amount to be raised by taxation from a two-mill levy upon the taxable property subject to taxation in said town, no recovery can be had for any amount in excess of the amount raised from such two-mill levy, under subsection 72 of section 2402, Compiled Laws of New Mexico 1897. A town or municipality, when sued upon a contract which it was not authorized by law to make, or has not complied with the statutory requirements in the making of the contract, is not estopped to deny the validity or want of power in making such contract, or prohibition by statute to secure the funds with which to discharge its obligations under the contract, and prevent a recovery upon a quantum meruit upon the contract. Hageman et al. v. Town of Hageman (N. M.) 141 Pac., 613.

Lease of Water Works Invalid if Really Unauthorized Purchase Contract.—An ordinance or contract of the town of Hagerman, termed a "lease," entered into for the purpose of securing a water supply for said town, whereby the town was to become the owner at the expiration of ten years, upon the payment of $900 per year as rental for such period, construed and held to be a contract of sale, and, as such, a purchase by the town of waterworks under subsection 6 of section 2402 Compiled Laws of New Mexico 1897, and such contract held to be invalid and un-

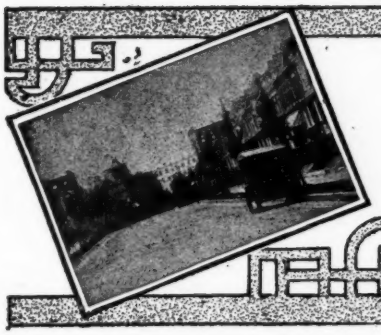
enforceable against the town in a suit to collect the rents by reason of such contract not having been approved by vote of the residents of the town at a general election. Hagerman et al. v. Town of Hagerman (N. M.) 141 Pac. 613.

Methods of Dedication of Streets.—Condemnation, dedication by deed or under the statute, and prescription, are not the only methods of creating a street, for a street may be created by common-law dedication, which arises out of acts by the owner showing on his part an intention to dedicate. No particular formality is necessary to a common-law dedication of land for a street, thus the mere throwing open of land to public use as a street, coupled with the fact that others purchase in reliance on the existence of the street, is sufficient. Time is not an indispensable element of a common-law dedication as in the case of prescription, and a dedication when accepted and acted upon is irrevocable, tho the property dedicated has not been used as a street for the prescriptive period. Drimmel v. Kansas City (Mo.), 168 S. W., 280.

Liability of City for Defective Sidewalk.—Until accepted, a municipality is not responsible for the condition of a street attempted to be dedicated. The acceptance of a street dedicated to public use need not be express, but may be implied from the acts of a municipality in doing work thereon or recognizing it as a public street. Where a city accepts the dedication of a street, and it is graded and a sidewalk placed thereon, that is an invitation to the public to use it, and the city is bound, regardless of who placed the sidewalk there, to maintain it in a reasonably safe condition for travel. Drimmel v. Kansas City (Mo.), 168 S. W., 280.

Authority for Changes in Contract for Bridge.—Laws 1903, c. 444, providing for the construction of a viaduct in the city of Milwaukee, required the county to prepare complete plans and specifications, to advertise for bids and let the contract to the lowest bidder, and to enter upon the construction of the viaduct, bridge, and approaches in conformity to such plans and specifications. *Held*, that such provision did not preclude the county from making any changes in the plans and specifications after the contract had been let, but that the county was authorized, as necessity required, to make proper changes. Section 668 declares that county board, by resolution, may authorize its chairman to appoint committees to perform the duties and report as prescribed in the resolution. *Held* that such committee had power to make changes in the plans and specifications, provided they did not substantially after the character of the structure or unreasonably increase its cost. *Held*, that, since the county in the first instance might have contracted that the required notice need not be in writing, it had power to waive such provision, and the engineer having made changes and ordered additions, with the approval of the county board or its committee in charge of the work, and having refused to make such orders in writing, the requirement was waived. Where a county board, engaged in the construction of a concrete viaduct of great proportions, delegated its powers in connection therewith to a committee of its members, and many of their meetings were necessarily of an informal character consisting of consultations with the engineer in charge of the work, at which all the members might not be able to be present, the rule that, where a statute requires a thing to be done at a meeting of the county board, the act cannot be done by separate individual action of the members of the board, but must be done at a duly called meeting, was inapplicable, and hence the fact that a change in the method of construction of arches was ordered at a meeting of the committee, at which all were not present or notified, did not render such action invalid. First Savings & Trust Co. v. Milwaukee Co. (Wis.), 148 N. W., 22.

Exclusive Contract to Collect Garbage Legal.—Under Rochester City Charter, Secs. 85, 235 (Laws 1907, c. 755), providing that the city shall have authority to preserve the health, safety, and welfare of its inhabitants, and that the board of contract may let contracts for the collection, removal, and disposal of ashes, garbage, and dead animals and for cleaning and sweeping the streets, the city could pass an ordinance prohibiting the collection of garbage by persons unlicensed by the bureau of health and then declaring that no licenses should be granted except to the person or persons having a contract with the city for the collection of garbage; such ordinance being a reasonable exercise of the city's police power, regardless of the fact that it might incidentally affect the rights of private persons to collect and use garbage. The validity of a statute or ordinance is not to be determined from its effect in a particular case, but from its general purpose and its efficiency to accomplish the end desired, and when a statute is obviously intended to provide for the safety of the community, and an ordinance under it is reasonable and in compliance with such purpose, both statute and ordinance are lawful and must be sustained. City of Rochester (N. Y.) v. Gutberlett, 105 N. E., 548. See also a Detroit case, Gardner v. Michigan, 199 U. S. 325; and a San Francisco case, California Reduction Co. v. Sanitary Reduction Works, 199 U. S., 306.



ROADS AND PAVEMENTS

Relation of Traffic and Cost of Maintenance of Roads

The annual report of the Massachusetts State Highway Commission discusses the relations of traffic, kind of wearing surface and cost of maintenance of roads in the following pertinent paragraphs and tables:

Many engineers in both France and England have for years past been keeping an accurate account of the actual cost of maintaining certain roads, and of the traffic which actually went over the road. Many of these accounts and experiences are extremely interesting and instructive.

A knowledge of the traffic which each particular road will have to carry is absolutely necessary if the best materials and methods of construction are to be used. The same is equally true concerning the methods and materials which should be used to maintain the road after it is built. The most economical surface to use with certain heavy traffic, including interest on cost and maintenance, may be 6-inch granite blocks on a concrete base, while for very light traffic a gravel road, always properly shaped and maintained, may be entirely adequate.

Before deciding upon any particular surface of pavement for any special road or street, if we are to decide correctly, it is absolutely necessary that we should know exactly what traffic, and particularly the kind of traffic, the road must carry, and not only the present traffic but the future traffic as well.

We found in Massachusetts that in three years, from 1909 to 1912, the traffic on our state highways had often doubled. Its character also had changed. Some roads had more heavy teaming—most of them had less, but motor trucks had replaced the teams, carrying actually more tons per day. Automobile traffic had more than doubled, and what were formerly little country roads, with but twenty to fifty teams a day, had now become interurban and interstate thorofares, carrying from 300 to 700 automobiles a day in the season.

What we need is some uniform method of taking traffic counts, and some uniform formula that will fairly represent the weight or damage done by the different kinds of traffic, based upon the weight per yard width per year, or per day, so that we can compare results. After a series of years we should then be able to determine more accurately the surface or pavement which would best meet all the necessary requirements.

Traffic statistics have been made for many years in certain places in England and on the continent. The English Road Board has adopted an assumed weight for various vehicles, and many traffic statistics based upon this formula have been made, and are now available in various reports. We could well adopt the same formula, based upon American tons, so that we could compare our results with theirs upon a uniform basis.

TABLE I—ENGLISH TRAFFIC FORMULA WEIGHTS.

	Assumed weight of vehicles. (Tons)
Motor Vehicles—	
Runabouts	1.43
Touring cars	2.23
Trucks	6.25
Horse-drawn Vehicles—	
Light vehicles (one-horse)	.36
Heavy vehicles (one-horse)	1.12
Light vehicles (two or more horses)	.54
Heavy vehicles (two or more horses)	2.46

The number and class of vehicles having been determined, the traffic per yard width of roadway can be calculated.

Mr. Brodie, city engineer for the city of Liverpool, has made some very accurate studies extending over a period of ten years, covering the weight of traffic per yard width per year, the life of the road, life tonnage per yard width, cost per yard, per ton, etc. His table, which is given herewith, can be studied with great advantage.

TABLE II—GIVING PARTICULARS OF EXPERIENCE OBTAINED IN LIVERPOOL WITH DIFFERENT CLASSES OF SURFACE PAVEMENT.

Pavement.	*Tons per yd. width per annum.	Life, years	Life, tonnage per yd. width.	Cost per sq. yd. of surface.	Annual cost, including prop'n of capital and maintenance per sq. yd.	Ton miles per yd. width per penny.	Cost per traffic per mile.
6-in. setts	524,000	18	9,432,000	$2.50	$0.170	34.0	$0.058
4-in. setts	150,000	50 (Est.)	7,500,000	1.87	.070	24.0	.080
Hard wood	162,000	17	2,754,000	3.37	.250	7.4	.272
Soft wood	204,000	18	3,672,000	2.12	.115	15.5	.128
4-in. pitch macadam	120,000	11	1,320,000	.75	.066	20.6	.096
7-in. water bound macadam	120,000	1	120,000	.02	.180	7.6	.264
7-in. water bound macadam, tar sprayed	120,000	2	240,000	.25	.112	11.4	.180

Note.—Tonnages on Road Board basis, except that which, being exceptionally heavy traffic, is based on estimated total actual weights.

*English ton—2,240 pounds.

You will note that the average cost of maintenance, including capital charges, varies from 7 cents for certain granite sets to 25 cents per square yard per year for certain wood blocks (7 cents for pitch macadam and 4-inch granite sets).

The pitch macadam was practically a trap-rock macadam where large stones were used, grouted with a mixture of hot sand and pitch, equal volume, till it flushed, and then smaller stones were rolled in, a surface coat and grits applied on top, and rolled in. One such road is now eleven years old, has not yet been repaired, and has carried a traffic of 120,000 tons per yard width per year.

On the average state highway in Massachusetts, with 15 feet in width of macadam, this would mean 600 to 700 vehicles a day; not, of course, on a real heavy teaming street, but average traffic.

These figures do not really, however, tell the story of the actual cost, but the cost per ton mile shows better what duty the road has performed.

The wood block carried less than 7½ tons per yard width for each penny expended, the pitch macadam carried over 20 tons, and 6-inch granite sets on a concrete base carried 34 tons. Water-bound macadam carried only 7 6/10 tons, but if it was tar sprayed, it carried nearly 11½ tons, for each penny expended.

Another way of stating the same result is the expenditure for maintenance for each ton transported 1 mile. This cost varied from under .06 of a cent per ton on 6-inch granite sets to about .27 of a cent for hardwood block and water-bound macadam; while tar-sprayed macadam cost .18 of a cent, or only two-thirds as much as water-bound macadam; and pitch macadam cost over .09 of a cent, or about half the cost of the tar-painted macadam.

Any engineer will find himself amply repaid if he makes a careful study of the traffic statistics and costs which are set forth in many of the papers, both French and English, presented at the International Road Congress, and in the reports of the English Road Board.

Note, also, that the kind of traffic which has to be carried, makes the most difference of all. Every road surface must be strong enough not to be crushed, or broken through, by any vehicle that goes over it.

On the Liverpool paved streets, near the docks, 30 tons on four wheels is not an unusual load. Traction engines on iron tires, weighing 12 tons with their load, are common, as are also two or three trailers, weighing, with load, 8 tons each.

Both surface and foundation must be strong enough to bear up every vehicle, without any appreciable rutting or breaking, or the road will be rapidly destroyed.

The cost on different roads in England is given in a table published in connection with the International Road Congress, pamphlet No. 88, report by Messrs. H. T. Wakelam, A. Dryland, Col. R. E. Crompton, C. B., and T. W. A. Hayward.

This table of costs is for water-bound macadam roads, and a very few tar-sprayed roads.

You will note that there are tremendous variations in cost. The maintenance cost on some of these roads is as low as 14/100 of a cent per ton mile, and on others as high as 1 2/5 cents. Evidently, much further study is necessary to show not only the reason but the remedy for some excessively high costs.

TABLE III—SHOWING WEIGHT OF TRAFFIC IN TONS CARRIED ONE MILE FOR ONE PENNY OF MAINTENANCE COST.

County. Place.	Weight of Traffic in Tons.	Per day.	Per annum.	Average cost per mile per annum.	Weight in tons carried 1 mile for 1 penny	Cost of maintenance in pence per traffic ton mile. (penny). (cents).
Norfolk—Weybourne	39	14,200	41 5	1.4	.71	1.42
Norfolk—Edgefield	96	35,000	16 "	9.0	.11	.22
Warwick—Gaydon Cross Rd.	185	67,500	86 "	3.2	.31	.62
Warwick—Wooton Waven..	239	87,200	127 "	2.9	.34	.68
Warwick—The Asps.....	242	88,300	86 "	4.3	.230	.46
Kent—*Near Charing.....	348	126,700	299 "	1.7	.590	1.18
Norfolk—Framlingham	359	131,000	73 5	7.4	.130	.26
Norfolk—Lyn-Ely	385	140,500	56 5	10.4	.096	.192
Norfolk—Diss	390	142,300	55 "	10.7	.093	.186
Warwick—Haselor Bar.....	451	164,600	127 "	5.4	.18	.36
Norfolk—E. Carleton.....	504	184,000	50 5	15.1	.066	.132
Kent—Road No. 20.....	528	192,100	348 "	2.2	.45	.90
Warwick—Willenhall	609	222,000	269 "	3.4	.29	.58
Warwick—Elmdon	734	268,000	419 "	2.7	.37	.74
Warwick—Styvechale	736	268,600	134 "	7.9	.127	.254
Kent—*Road No. 91.....	796	289,800	192 "	6.3	.16	.32
E. Sussex—Roedean	984	359,000	333 "	4.4	.22	.44
Norfolk—Diss 1,057		386,000	218 "	7.3	.13	.26
Kent—Sidcup 3,030		1,102,810	2,100 "	2.1	.47	.94
Kent—*Sidcup 3,030		1,102,810	1,792 "	2.5	.40	.80
Surrey—Putney 5,694		2,078,300	1,032 "	8.4	.12	.24
Surrey—*Putney 5,694		2,078,300	604 "	14.3	.08	.14
Average of Norfolk Roads..9,023		3,300,000	2,298 "	6.0	.16	.32
Av. of Warwickshire Roads.9,777		3,569,000	3,965 "	3.7	.27	.54

*Note—Surface tarred.

COMPARISON WITH TWO MASSACHUSETTS ROADS.

*Beverly 2,898		1,058,430	$3,257	6.50	.185	.37
*Weston 1,920		699,924	1,993	7.02	.14	.28

*Period of 14 years.

I have shown two of our state highways merely for the purpose of comparison, and you will note that the cost of water-bound macadam roads is about the average. Where it costs more it becomes evident from looking over the Liverpool statistics that the pavement is entirely inadequate to carry the loads which are going over it.

These statistics, varying as they do, show the absolute necessity for accurate traffic data as a prerequisite to the selection of a road surface or pavement.

In some of the reports of the French engineers, many costs are given which are of much value for traffic in this country. For instance, the Avenue du Bois de Boulogne in Paris was maintained as water-bound macadam until 1906. It had to be renewed every three years. The annual cost for maintenance was about 39 cents per square yard per year. In September, 1906, it was tarred, and the annual cost of maintenance has fallen to about 25 cents per yard per year, or about two-thirds. It must be remembered that this is a very wide avenue with a tremendous traffic in automobiles and pleasure vehicles, but with little or no teaming.

Asphalts and asphaltic residuums have been but little used in England or France, probably because the tar products are much cheaper, so that it remains for us in this country to keep accurate data, and costs figured on a uniform basis, to determine in each locality what is the best and most economical material that can be used on that particular road, to carry adequately the traffic which will pass over it.

An Unsupported Brick Highway in Continuous Use.

By Herschel H. Macdonald.

For sixteen months a rural brick pavement, 70 square yards in extent, has hung over the void near Tinker's creek, Cuyahoga county, Ohio. Now the county commissioners are preparing to put a roadway and a base under their pavement.

There is no apparent reason for their step, except the caution which is always counted an official virtue. The pavement has projected like a roomy shelf over the void, 80 feet long and 6½ feet in width, ever since March, 1913. For some time

WASHOUT *of Dunham Road brick pavement by Tinkers Creek, near Cleveland, O. Note brick surface intact and that much of the concrete foundation has dropped out. Sections of concrete wall are lying in and along the water of the creek across the foreground of the picture, with a standing section at the left partly undermined.*

the pavement was used without a guard rail. Later a guard rail was erected to keep vehicles from venturing over the edge of the shelf.

It will be remembered that floods visited Ohio in March, 1913. Dayton was the heaviest sufferer. Northern Ohio, owing to the depth of its river valleys, escaped with little damage. Part of the damage, however, occurred where Tinker's creek runs parallel to Dunham road. At this point a retaining wall of heavy stone blocks had been erected and the road built up to a height of some 12 feet above the bed of the creek. Upon the fill a modern brick pavement with a concrete base had been constructed.

The flood completely submerged the road for several days and when it receded, it was found that the wall had been undermined and scattered for a distance of several hundred feet down stream. Nearly half of the roadway had been excavated by the force of the water and the concrete base, deprived of its support, dropped to the bed of the creek.

All that remained was the actual pavement, an unbroken surface of well-grouted brick. The first impulse of the road authorities was to break down the brick shell, to prevent its use, and to rebuild the entire road from the bottom. A man with a sledge was set to work to demolish it. When he had labored for ten minutes and had only broken a single brick, the man in charge decided that such a pavement could not be much of a menace to traffic and so allowed it to stand.

The fame of the phenomenon spread and people came by the score to behold a highway supported by the ether. Innumerable automobiles ventured to the edge of the overhang, until caution dictated a fence along its edge to prevent vehicles from plunging into the creek. A portion of the width of the overhang, however, has always been subjected to traffic since the washout.

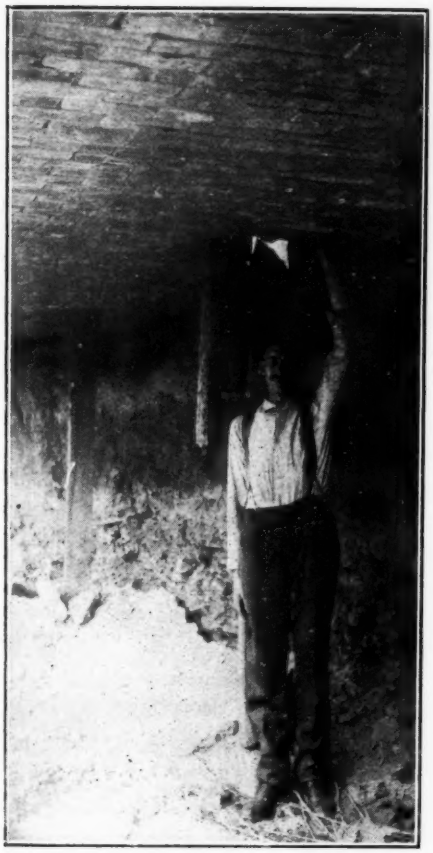
The incident has proved a most effective lesson in a cardinal principle of good paving practice, a principle which has made Cuyahoga county roads conspicuous thruout the country. That is the proper use of a grout filler composed of one part Portland cement and one part of fine, sharp sand.

This lesson was not learned in a day, either in Cuyahoga county or elsewhere. Its experimental era was marked by many roads of merit. The early builders were fortunate in being allowed to correct their own mistakes, as well as in the fact that they prepared a type of road that would withstand auto traffic long before that traffic could have been foreseen.

The Dunham road pavement presents no unusual features, excepting the strange test to which it was subjected, which, impressive as it is, was not made under conditions, the identical of which might be found in any properly constructed brick highway.

Arch action can have played no part in maintaining the pavement's position. The longitudinal grade of the unsupported portion is an almost perfect level. There is a slight lateral crown comparable to a half-arch, but it is the crown rather than the base of the arch which is supported. The base has no support excepting the lateral bond.

Lest authorities seem to have been remiss in allowing repairs to be so long delayed, it is only fair to say that the principal delay was caused by a project to divert the road, which would have involved the condemnation of land and other lengthy controversy. The delay, however, has been an advantage from the standpoint of the test, as time and the frost action of a severe winter have made the demonstration daily more impressive and opportunity has been afforded for a large number of paving experts to visit



WASHOUT *of Dunham Road brick pavement near Cleveland, O. This photograph shows the underside of the brick pavement and the extend of its overhang, 6¾ feet. The posts seen were set to hold a railing to keep traffic from the edge and do not support the pavement in any way. Traffic passes regularly over the brick pavement between these posts and the earth on the right, which supports the other half of the pavement.*

the scene and glean such practical lessons as might be had from close inspection.

More than 150 engineers and road authorities, from all parts of America, went to Tinker's creek in a body to satisfy themselves with regard to a situation which had been heralded to most of them thru the technical journals.

At first they approached it with caution, but curiosity and admiration overcame them and they were soon distributed over and under the shelf without apparent fear of collapse, so much were they impressed by the evident rigidity. No feature of the conference made so deep an impression nor excited so much comment, and the program included visits to more than fifty miles of pavement in various stages of construction and age.

Cleveland and Cuyahoga county now boast more than 1,100 miles of brick paved city streets and country roads, forming what engineers declare to be the most remarkable system of permanent paving to be found in the world.

Asphalt Paving Repairs in St. Paul, Minn.

In the budget of St. Paul, Minn., for 1912, $15,000 was appropriated in the general fund for the purchase of equipment for making street paving repairs. In February bids were called for for a portable asphalt plant, and later other equipment was purchased under competitive bids. The entire plant installed under this appropriation and in use in 1912 consists of a Warren Brothers portable asphalt plant, one 8-ton asphalt steam roller, one scarifier, one Lutz surface heater, one fire wagon, one gyratory stone crusher, two portable melting kettles, six 2-yard steel-lined asphalt wagons, four ¾-yard concrete spreaders, one set of curb-cutter's tools, nine asphalt rakes, testing scales and the necessary small tools.

The plant was put in operation on April 25, and during the season of 1912 was worked a total of ninety-two days; 19,428 square yards of asphalt pavement were turned out, 15,040 square yards of this being cut-out work and 4,388 square yards burner work; 5,458.63 square yards of asphalt were put in for paving contractors in repairing asphalt pavements under guarantee; of this, 2,363 square yards was cut-out work and 3,095 square yards burner work. The total cost was $6,012.96, which was billed aganist the contractors and collected in 1912.

All asphalt paving repairs for the year 1913 were made by the municipal asphalt plant. The plant was put in operation March 30, and during the season worked 178 days; 44,193.71 square yards of asphalt paving were turned out, 43,296.36 square yards of this being cut-out work and 897.35 square yards burner work; 16,832.42 square yards of asphalt were put in for the Barber Asphalt Paving Company on streets still under guarantee; of this, 16,039.51 square yards was cut-out work and 792.91 square yards was burner work. The total cost was $21,613.34, which was billed against the company and collected.

7,370.13 square yards of asphalt were put in for the City Railway Company and billed against it, the cost being $11,031.76. 1,249.78 square yards of asphalt

and 147.79 square yards of concrete foundation were put in for public service corporations. This work cost $2,340.65; was billed and collected.

245.99 square yards of asphalt were put in on bridges on which the city maintains the wearing surface; this cost $430.49, and was charged against the bridge building and repair fund at $1.75 per square yard. 8.20 square yards of asphalt were put in openings in street made by city sprinkling department; this cost $14.35, and was charged against the city sprinkling department at $1.75 per square yard.

The repairs to asphalt pavements out of guarantee and paid for out of the street and sewer fund amounted to 18,487.19 square yards of cut-out work. The repair work cost the city $18 490.85, or an average of $1.00 per square yard.

ASPHALT PAVING REPAIRS, 1913.

City repairs made by municipal plant	$18,490.85
City railway repairs made by municipal plant	11,031.76
City bridge repairs made by municipal plant	430.49
City sprinkling department repairs by municipal plant	14.35
	$29,967.45

The distribution of the expense is as follows:

Street and sewer fund	$18,490.85
Bridge building and repair fund	430.49
City sprinkling department fund	14.35
City Railway Company	11,031.76
	$29,967.45

The following shows cost and relative data regarding asphalt repairs for the year 1913:

Total area of pavements on which repairs were made, in square yards	222,327
Area of repairs in square yards	18,733.18
Per cent. of area repaired	8.42
Cost of repairs	$18,921.34
Average cost per square yard of total area	0.085

Cuts in the asphalt pavement made by the water department, heating, lighting and telephone companies, sewer contractors and others, which were repaired, cost $2,340.65, which was collected from the various companies.

The operating crew at the plant consisted of one foreman, one engineer, one tank man, four laborers and a night watchman. Four teams were employed hauling asphalt from the plant to the work.

The street crew was made up of one foreman, one timekeeper, one roller man, two rakers, two tampers, one smoother and one cement man, laying the new pavement, and two shovelers, six scrapers and two teams removing and hauling the old paving. The total expense was divided as follows:

SUMMARY.

Operation of plant, labor		$ 5,889.02
Fuel		1,024.47
Hauling material		1,559.18
Superintendence, livery, watchman, etc.		3,164.21
Repairs and supplies		1,658.05
Material		26,876.59
Street crew labor		8,206.66
Hauling material to street		5,068.40
Engineer and watchman		1,391.65
Tools, repairs, etc		790.05
Total		$55,628.28
Total labor	$25,175.66	
Total material	30,452.62	
		$55,628.28
Charged to outside parties	$34,194.23	
Charged to bridges	430.49	
Material on hand	2,512.71	
		37,137.43
Total cost of city work		$18 490.85

European Rock Asphalts

Lecture by J. W. Howard at Columbia University.

IT is an honor to respond to the request of Columbia University and present a brief professional paper on the subject of "European Rock Asphalts," which were used for the first successful monolithic or sheet asphalt pavements and other purposes, and are still used extensively thruout Europe and elsewhere. Subsequent to the success of the European rock asphalt or bituminous-limestone pavements, many substitutes, made of artificial compounds, have been used. Success has followed the use of certain compounds of graded sand or graded crushed stone, limestone, or equivalent powdered mineral in small quantities filling voids, and the whole mineral aggregate bound together with asphalt cement. This second general method of constructing asphalt and bituminous pavements was developed in America and predominates here. I will confine your attention to a sub-group composed of natural bituminous limestone, which is one of the general group of rock asphalts, which group also contains natural bituminous sandstone, of relatively little value.

1. *Definition.*—It is best to clearly define the sub-group of bituminous or asphaltic materials to which I call your attention. The deposits of rock asphalt of Europe are natural, bituminous lime-

stone which have been used for more than two hundred years; at first for various coatings and extracting bitumen, and then, beginning about one hundred years ago, for pavements and other purposes. This mineral is composed of fine-grained limestone, thoroly impregnated and saturated with an adhesive, durable bitumen. The bituminous limestone deposits or quarries of Europe, and the few known ones in America and other countries, vary in purity and quality, some of the deposits containing some qualities of sand, clay, etc., in some parts, if not thruout each deposit. The proportion of bitumen or asphaltum present in the rock varies in all deposits from portions not saturated at all, to portions carrying the desired per cent. of this cementing substance and upwards to a large excess of bitumen in the rock, which makes it impossible to use such rock asphalt unless it is thoroly blended with other similar, suitable rock asphalt containing very little asphaltum or bitumen, so that a uniform result contains the per cent. of bitumen required.

2. *History.*—A rapid glance at the names of ancient authors mentioning asphalt, from the Greek word, "asphaltos," and "bitumen," which is a Latin word itself, and known by other words by Hebrew, Babylonian, and other writers, is interesting. The knowledge or uses of asphalt or bitumen, and some compounds, is not new. The following ancient writers, with approximate dates, can be consulted in any large library. The earliest mention I have found is on "Tablet No. 11 of Gilgamesh Epic," antedating four thousand years before Christ, or six thousand years ago, where Utnapshtim states that he "smeared or coated the inside (of a boat) with six measures of Ku-up-ri (bitumen) and the outside with three measures." The Hebrew writers in the Old Testament mention coating the ark, also the basket of Moses, etc., with asphalt, which was long before the present era began. Next followed Greek and Roman writers; Homer about 1000 B. C., Herodotus 430 B. C., Hippocrates 410 B. C., Aristotle 355 B. C.. Diodorus 50 B. C., Virgil 10 B. C., Ovid 5 A. D., Pliny 70 A D,. in his "Natural History II.," 106-108. An unknown author, about 1325, mentions it. Mandeville and Trevisa, in the fourteenth century; Copgrave about 1640; Whitehorn, sixteenth century; Shakespeare, 1600; Milton, 1650; Blount, 1656. It was not till 1712 that Doctor D'Eyrinys discovered, and in 1721 published, a description of the rock asphalt at Val-de-Travers, Neufchatel County, Switzerland, and several uses for this material. This was the small beginning of the asphalt industry, which has now spread, in various forms and by various methods of using natural or combined materials, thruout the world, employing many millions of capital in competing groups, large and small, and employing many thousand men. D'Eyrinys, in 1735, opened the bituminous limestone deposits at Lobsann (Germany), which deposit has been worked ever since. About 1797, the deposit at Seyssel, France, was opened, and then, like the others, was used for making asphalt-mastic by extracting the bitumen from some of the rock and enriching the powdered fresh rock with it. In 1802, Count de Sassenay took charge and reformed the methods, very much improving them, getting his supplies from the Swiss and French deposits mentioned. Rock asphaltic-mastic was soon used for floors, sidewalks, public squares, bridges, and then streets. It was in Lyons, France, about 1834, that in mastic form, it succeeded fairly well for street paving. In the same year it entered Paris and rapidly became the almost universally-used, excellent sidewalks of that city, where now more than eighteen hundred miles of it are kept in constant good order. Engineer Meriam began about that time to observe that lumps of the broken and powdered bituminous limestone, dropping from wagons near the quarries, were crushed and coalesced under wheel traffic into a firm, continuous sheet on the roads. It was then that the noted engineer, Leon Malo, of France, entered this industry and devoted his life to it until his death, a short time ago. He is known thruout the world as the father of the asphalt industry. Mr. Delano, of England, collaborated with Mr. Malo in France, and introduced sheet asphalt pavements, made of European rock asphalt, and asphaltic-mastic sidewalks, floors, etc., into England and the cities of almost all nations. He still takes interest in the rock-asphalt branches of the asphalt industry.

It was in 1854 that Mr. Malo, after some experiments, laid the first successful sheet-asphalt pavement. It was made with compressed natural rock asphalt. He demonstrated the necessity of a firm concrete foundation. The wearing-surface layer was made by crushing, powdering, and then heating the bituminous limestone and spreading and compressing it in place on the street. This first street was Rue Bergere, Paris, which, from the first, was successful, and by proper maintenance it has been kept thus paved in constant good order for sixty years to date. At this point it is wise to insert a brief list of authors and authorities on bituminous limestone and its uses. Busch, about 1802, d'Aoust (1834) Purvis (1836), Itier (1839), Millet (1840), Huguenet (1847), Daubree (1850), Hessell & Kopp (1855), Benoit (1860), Homberg (1865), Leon Malo (1866), and his subsequent publications, Delano (1871 to 1893), Jeep (1867), Meyn (1872), Coignet (1875),

Kayser (1879), Woas (1880), Zetter (1880), Ducker (1881), Wein (1881), Dietrich (1882), Schubarth (1883), Narcy (1889), Baumeister (1890), Lonholdt (1891), Jaccard (1895), Haft (1897), Loewe (1906), Boorman (1908), Danby (1913), all of which give more or less details regarding sources of supply and methods of use of the rock asphalts of the kind we are considering.

The success of compressed rock-asphalt pavement in Paris in 1854 and ever since has attracted the attention of all important cities. London, England, began its use by paving Threadneedle street, in 1869, and has steadily extended its use to many other streets of that city. Geneva and Berlin began in 1871, and all the principal cities of Europe soon followed. It began to be used in America, and in 1876 a portion of Pennsylvania avenue, Washington, D. C., was paved with it. Its extensive use in America is prevented, first, because of the heavy freight charges from Europe, and secondly, because of the invention by DeSmedt, of the American form of sheet asphalt pavement, when he laid his first piece on William street, Newark, N. J., in 1871, then in other cities, and in 1876 on a portion of Pennsylvania avenue, Washington, D. C., where his artificial composition of sand, limestone powder, and asphalt cement proved successful. This American substitute and rivalry rapidly spread to all important cities and many smaller ones of America, and has been used to a limited extent in other countries.

The rock asphalt pavement of Europe must be transported in its entirety from the quarries to the city where used. Freight, therefore, is a large factor in its cost and confines its use within certain freight radii of the various deposits where the asphaltic limestone is found. On the other hand, the American system uses sand, found generally near the cities, and requires transportation of the asphalt cement only, which composes about ten per cent. of the weight of the pavement. The rock asphalt deposits of America are so isolated from large cities that there is relatively little demand for compressed, asphalt-limestone pavements, altho a few have been laid with American asphaltic limestone in a few cities in or near Utah and Texas, where there are some rock asphalts, similar but not exactly like those of Europe.

3. *Sources of Supply and Composition.*—The following tables will enable you to grasp quickly the classification of various bitumens and the relative positions of rock asphalts, both bituminous limestone and bituminous sandstone. Kindly remember it is bituminous limestone we are considering.

The countries where asphalt limestone is found are shown in the first part of Table II. The principal sources of supply during the past two hundred years are at various deposits or quarries located in France, Italy, Sicily, Germany, Switzerland, and Russia, within a long belt of limestone, at points where the limestone is impregnated or saturated with asphaltum. In a general paper of the kind I am presenting, it is not necessary to enumerate all of the many large and small quarries of rock asphalt which have been opened and are in use in Europe and the few elsewhere. Table III gives the locations of typical, operated deposits in Germany, France, Italy, Sicily, Switzerland, Spain, Russia, and of two of the three in Oklahoma, Utah and Texas. Table III also gives chemical analyses of samples from each of them. It must be remembered, however, that the per cent. of asphaltum or bitumen in the asphalt rock in each deposit varies somewhat from the samples analyzed, according to the portion of the quarry from which the sample is taken. There are other deposits in the countries named, but those enumerated are sufficient to illustrate the principles before us.

4. *Methods of Obtaining or Quarrying. Preparation and Shipping.*—The methods of obtaining the crude material are the usual ones, with certain variations, used in quarrying any limestone. At some of the deposits where warm weather makes it difficult to drill or bore holes for blasting or breaking out the rock asphalt, due to the adhesiveness and gummy nature of this rock when warm, the mining or quarrying is carried on in drifts or tunnels underground. In such places quarrying in cold weather is in the open.

The rock is shipped either in broken lumps or in ground, powdered form, according to the distance to be shipped, or as ordered. The customs duty from one country to another varies whether the rock is in lumps or labor has been paid to powder it. Previous to use for almost all purposes to which rock asphalt is applied, it is crushed, generally in special-toothed rolls, altho in cold weather jaw-crushers can be used. It is then reduced to powdered form by centrifugal pulverizing machines or sometimes by special flail or beating machines.

If used for compressed sheet asphalt pavements, rock must be selected having a uniform and requisite per cent. of bitumen in it suitable for the climate, traffic, and slightly different rock from different quarries. It is customary to blend the rock when necessary from parts of a quarry or from different quarries to get the desired results. For paving streets, the powdered rock, in its natural state, is warmed at the place where it is to be used for asphalt pavement for vehicle and other heavy traffic, or for other uses where this compressed, solid form of rock

TABLE I. CHARACTER AND LOCATION OF NATURAL BITUMENS AND COMPOUNDS

	Bitumen	Character	Where Found
Important Bitumens and Compounds.	Natural gas.	Gaseous.	North America, South America, Europe, Asia.
	Natural naphtha.	Thin fluid.	North America, South America, Europe.
	Petroleum.	Thick, oily.	North America, South America, Europe, Asia.
	Maltha & compounds.	Soft at 77°F., called also "Soft Asphalt."	N. Amer., S. Amer., Europe, Asia, Africa, Australia.
	Asphaltum & compounds.	Stiff at 77°F., "Hard Mineral Pitch."	N. Amer., S. Amer., Europe, Asia, Africa.
	Glance pitch.	Brittle at 77°F., "Mineral Pitch."	North America, S. America, Asia, Africa.
	Elaterite.	Elastic, "Mineral Rubber."	North America, South America, Europe, Asia.
	Ozocerite.	"Mineral Wax."	North America, Europe, Asia.

TABLE II. ROCK ASPHALT

Compounded with Limestone. (Containing Silicates, etc.) Found in Austria, Cuba, France, Germany, Hungary, Italy, Russia, Sicily, Spain, Switzerland, Turkey and United States.

Compounded with Sandstone. (Containing Carbonate of Lime, etc.) Found in France, Germany, Italy, Russia, Sicily, Spain, Turkey, United States, Alaska and Canada.

Table III. ANALYSES OF BITUMINOUS LIMESTONES (ROCK ASPHALT).

	Germany			France		Italy		Sicily	Switzerland	Spain	United States		Russia
	Limmer	Lobsan	Vor Wohle	Seyssel	Mons	St. Valentino	Cesi	Ragusa	Val de Travers	Maestu	Utah	Texas	Sysran
Asphaltum	14.30	12.32	8,50	8.15	10.20	8.83	7.15	8.92	10.15	8.80	36.28	11.65	30.50
Carbonate of Lime	67.00	71.43	80.04	91.30	84.63	80.00	73.76	88.21	88.40	9.15	29.52	.03	66.23
Sand	....	3,15	....	....	....	....	14.24	.60	....	68.75	6.46	88.32	....
Aluminum and Iron	....	5.91	....	.15	....	....	....	.91	.25	4.35	27.44	....	....
Sulphur	....	5.18	4.03	....	....	....	3.02	....	....	....	....	....	....
Magnesium-Carbonate	17.52	.31	.55	.10	....	....	....	.96	.30	8.10	....	....	3.27
Insoluble in Acid (h.cl.)	....	....	4.77	.10	....	....	.10	....	.45	....	....	....	....
Undetermined	1.18	1.70	2.11	.20	5.17	11.17	1.73	.40	.45	.85	.30	....	....
Total	100.	100.	100.	100.	100.	100.	100.	100.	100.	100.	100.	100.	100.

NOTE—The materials vary somewhat from each deposit.

asphalt is required. The warmed material is spread upon a suitable foundation and compressed by ramming with hot, heavy, iron rammers, which condense the material to the necessary density and solidity. The surface of the pavement is smoothed with hot smoothing-irons, which must not be so hot as to burn the bitumen in it. A heated, heavy, hand-roller is also used to smooth out any indentations left by the rammers. Subsequent to its first construction, such rock asphalt pavements are further compressed a little by traffic. The result is a dense, durable, waterproof, monolithic pavement, which, with reasonable maintenance, can be kept in constant good order indefinitely.

If the rock asphalt is to be used for making asphalt-mastic, then it is heated for several hours in revolving, large, mixing cylinders, into which is introduced some pure or relatively pure asphaltum or asphalt cement, from other sources. The result is that the natural bituminous limestone has its bitumen enriched until the per cent. in the asphalt-mastic is raised to the amount desired, generally about 20 per cent. This mastic, while hot, is run into forms or molds, so that the mastic is shipped all over the world in cakes of different forms and with different brands, according to the source of the supply or manufacturer.

The asphalt-mastic, on arrival at the place to be used, is melted in special kettles, at the same time mixing with it some more asphaltum or asphalt cement, and adding suitable sand and sometimes very fine gravel, according to the purposes or uses intended.

5. *Uses.*—The two principal uses of natural asphaltic limestone, called also bituminous limestone and rock asphalt, are for constructing the wearing surface layers of sheet asphalt pavements for streets and equivalent requirements; also for manufacturing rock asphalt-mastic for use in various compounds for sidewalks, floors, roofs, decks, waterproof linings, damp course, pavement of bridges, etc. It is used all over the world in breweries, sheep, pig and cattle pens, cellars, coach-houses, conservatories, grain houses, courtyards, fish markets, warehouses, gunpowder magazines, laundries, lavatories, malt houses, markets, railway platforms, freight houses, playgrounds, slaughter houses, stables, wash houses, etc. It meets conditions where surfaces are needed which will not crack or deform from expansion and contraction of heat and cold or from slight settlements and deformation of floors, foundations, and structures, which surfaces at the same time resist moisture and the wear of foot and other light traffic.

It is not the province of this paper to go into the many and minute details of technical preparation and methods of use for each of the many applications of rock asphalt. The industry is large and its subdivisions too many to be presented otherwise than in the several available publications on the subject, the authors of which I have named.

The most successful use of bituminous limestone depends principally upon the selection of a good quality of natural rock and practical experience in handling it. Experienced foremen and trained laborers in this industry are available almost everywhere.

Fibered Asphalt Pavement

Nearly two years ago a small area of pavement was laid by the Memphis Asphalt Paving Co., using a mixture of woody fibre, from which all chemically active ingredients had been removed, and Trinidad asphalt. This pavement was thoroly rolled with a heavy roller and has successfully withstood the many heavy loads passing over it daily to and from several manufacturing and commercial establishments as well as the climatic changes of that latitude.

A few weeks ago a few square yards were laid on a part of a street intersection in the city of Indianapolis, which has behaved itself well in the heat of an unusual summer. Still later some patches were laid with the same woody fiber mixed, part with California asphalt and part with California asphalt and some pounds of stone dust. These patches were not fully compacted, the roller used being a small asphalt repair roller.

Part of the patches made with the mixture of asphalt and fiber without stone dust did not keep their places but part of them have, and the mixture of stone dust seems to have produced a hardness in the patches where it was used which is similar to that in the earlier mixtures of fiber and Trinidad asphalt, so that these patches are holding up well.

All these sections of the experimental pavement are under close observation and their condition will be reported from time to time. So far the indications are that a promising new material has been found which will probably be able to compete in price, at least as long as the supply of fiber can be kept up, with other pavements of equal quality and resistance to traffic. The point made by the originators of the pavement is the inherent stability due to the action of the fibrous material in the mixture in resisting change in form or consistency. Trinidad asphalt offers the inorganic matter thus far indicated to be necessary to produce proper co-operation of bitumen and fiber.

Lighting

High-Pressure Gas for Street Illumination

HIGH pressure gas illumination for important streets has been extremely successful in London, Paris, Berlin and large provincial towns such as Birmingham; in several cases the installations have been less successful; it may therefore be interesting to draw attention to only partial success, in order that the system, wherever introduced, may always give the best results possible.

All the practical advantages claimed for electric lighting, such as simplicity of switching operations, possibility of dispensing with lamp lighters, great economy of cost, and so on, are actually obtained by the use of gas high pressure installation.

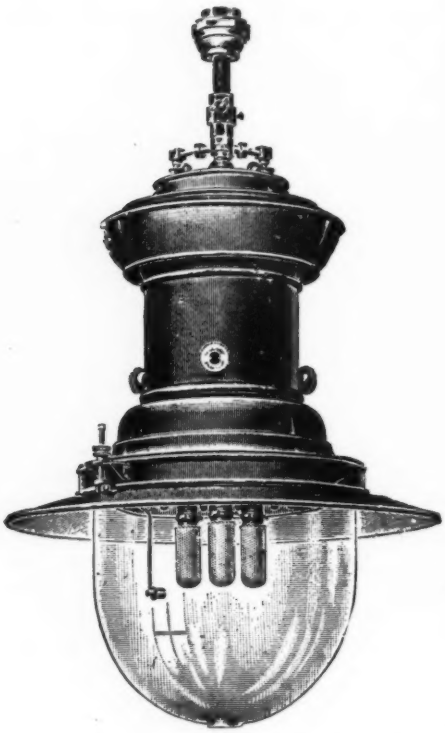
A complaint of extensive and highly dangerous leakage of high pressure gas is only made possible by neglect on the part of main-layers and is easily avoidable. All mains, after being laid, must be made subject to severe tests and any subsidence prevented by bedding the mains where necessary on a foundation of concrete.

No detrimental effect is caused by foggy or heavily smoke-laden atmosphere on the gas mantles, resulting in any diminution of candle-power. Ordinary foggy weather does not affect them at all, also not the ordinary smoke of a manufacturing district. During extraordinarily bad weather street lamps may be burning both day and night, thus eliminating any remote possibility of smoke settling on the mantles. It is also important to note that the rays of gas lamps penetrate fog considerably better than those of electric lamps.

The great objection to electric street lighting is the intense glare of the arc lamps, which electrical experts are anxious to reduce, as it tells against their system. In this respect gas lamps are superior for the eyes, because the source of light is immensely larger than the arc of the electric lamp.

There is still ample scope for both gas and electric light engineers to experiment with the object of improving the distribution of light. Such experiments, if they resulted in nothing else, would also probably lead to improvements tending to lengthen the effective life of the gas mantles, which are at present insufficiently protected from the weather. Some experts assert that all sources of light should be screened down so that their intrinsic brilliancy does not exceed that of the sky, which has been estimated at about three candle power per square inch.

The measurement of light and illumination has now become a science, the degree of accuracy of which is only limited by the personal error of the observers using the photometric instruments. Street photometry can be practiced within an accuracy of 5 per cent. of the direct candle-power measurements and within 7 per cent. of the horizontal illumination measurements. To measure the illuminating effect of high pressure gas lamps a portable photometer may be used for rough measurements, fitted with a Bunsen screen; also the type known in Europe as the universal photometer, the accuracy of which is very high, as the flicker attachment is used for direct measurements, thus reducing to a minimum any error due to variation in color of light sources. The artificial illumination of streets being carried out by means of light sources fixed at intervals along a street, results in a varying degree of illumination, depending on the distance from the light sources and as that illumination is proportionate, not to the distance only, but to the square of the distance and the angle at which the light falls on the surface, it will readily be seen that much depends not only on the candle power of the lamps, but even more on the way they are spaced along the street and the height at which they are erected. With the object of bringing all the factors, namely, candle-power, distance and height into a common factor for comparison, it is becoming the practice to compare the illumination of streets by ascertaining the minimum horizontal illumination at any part of the street on a screen three feet



KEITH'S HIGH PRESSURE GAS LAMP, *giving 2,000 to 4,500 candle power with steel reflectors.*

above the ground level. This minimum factor is considered the important one, as it embodies all others, also because if the minimum illumination is sufficient for the pedestrian and road traffic, the illumination thruout the remainder of the street must be sufficient.

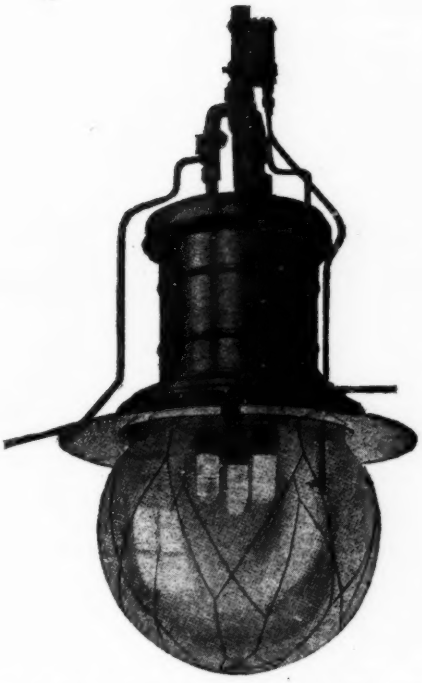
In order to test high pressure gas illumination of streets satisfactorily, a series of tests should be made extending over a period of several weeks, including photometric measurements of candle-power and illumination, which should be carried out every consecutive night, weather permitting. Periodic measurements of the gas consumption and gas pressure should be made to check those recorded by the gas meters and recorders installed. Whilst tests are being made, the lamps in the street under examination must be operated precisely in the manner usual in ordinary practice; adjustments and alterations being only permitted when found to be absolutely necessary.

The following details of actual tests made on high pressure gas street lamps will give point to what has been stated above. The lights tested are known as the Keith high-pressure gas lanterns, each containing three inverted high-pressure mantles, supplied with gas raised to a pressure of 55 to 60 inches of water by means of a compressor plant placed in an adjoining street; the pumps of which of which were driven by electric motors.

The lamps were suspended from span wires. A tower ladder was used to adjust, trim and clean the lamps. Lowering gear could alternatively be used. The central hanging of light sources has many advantages to recommend it, where powerful light units are necessary, as in very busy thorofares. The most important are that the lamps can be erected at a considerable height, so that they do not come into the line of vision of either pedestrians or drivers of vehicles using the street; furthermore, the lighting of the footpaths is much more even than when the light sources are carried on poles erected at the edges of the footways. A further advantage is, that poles being rarely needed for supporting the span wires, the footway is freer from obstacles to the traffic. The only serious disadvantage is the inaccessibility of the lamps. In the case of high pressure gas lamps, the lowering gear may cause trouble with the joints. It has, therefore, been suggested that the lamps could be supported from brackets attached to the buildings.

The average height of the lamps tested was 26 feet 6 inches and the average distance apart 107 feet; that would mean 49 lamps to the mile of street. Most of the photometric measurements were made at the following angles: For the maximum illumination from the rays 45 degrees from the horizontal and for the minimum 20 to 25 degrees from the horizontal. Very numerous measurements, extending over several weeks, gave the following results: Average candle power at 20 to 25 degrees from the horizontal, 1,750; average at 45 degrees from the horizontal, 1,670. Average minimum horizontal illumination derived therefrom on the pavement, 0.39 ft. candles; the average maximum horizontal illumination on the pavement, 1.9 ft. candles.

The costs, excluding capital charges on lamps and special mains, were made up as follows: Of the cost of low pressure gas delivered to the compressor, plus the cost of compressing, the cost of mantles and renewable parts, labor charges of lighting, extinguishing and renewing parts. The cost of the low-pressure gas delivered at the compressor station amounted to 25 cents per 1,000 cubic feet, to which has to be added the cost of compressing, 4 cents per 1,000 cubic feet, making a total cost of 29 cents per 1,000 cubic feet, delivered into the high pres-



GAS FOR STREET LIGHTING. *Welsbach lamp producing sixty candle power per cubic foet of gas burned.*

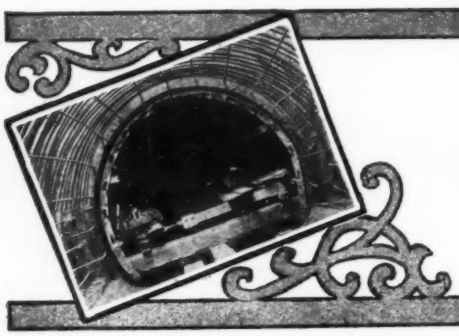
sure mains. Careful consumption tests showed that the consumption per mantle was 26.5 cu. ft. per hour; equal to 79.5 cu. ft. per hour for each lamp, giving a cost per hour for high pressure gas of 2.294 cents per hour. To this must be added the cost of mantles, globes and labor, making the total 3 cents per hour. The capital cost of plant and apparatus, including lamps, lanterns, poles, suspension and all accessories, amounted to $240 per lantern, apart from cost of the high pressure gas mains and compressor plant. The capital cost per mile of street would, therefore, amount to $11,760. During the time the tests were being made the maximum variations of any one gas lamp were from 2,058 candle power to 686 candle power, and for all the gas lamps tested, from 2,475 candle power to 686 candle power. It was stated above that the gas lamps cost three cents per hour, equal to $60 per lamp per annum of 2,000 hours. That would amount to a cost of $3,240 per mile of street; the capital costs per mile of street would amount to $12,177.60.

High pressure gas lamps used for street lighting, have on occasion been found not to give the full results expected, thru not being properly installed or adjusted. It is of extreme importance that the correct height should be ascertained. The height given above, 26 feet 6 inches, is too great to yield the best results, it only gave 27 candles per cubic foot of gas; when placed at a more suitable height the efficiency should be at least 50 candles. Lamps placed at a height of 20 feet, with only two burners, adjusted to a proper efficiency, would give a light equal to, if not better, than the three-burner lamps discussed above. The life of a mantle was found to be 400 hours, therefore each three-burner lamp would require 15 mantles per annum of 2,000 hours. The capital outlay has been found to be as follows: Per lamp, $58; for installing same, wages, poles, suspension gear and other smaller items, $180. To obtain the lowest working cost it is necessary that the compression should be worked to its full capacity. The cost given above for compression is too high because the compressor was not worked to its full load. The flexible connection to a high-pressure gas lamp requires careful watching, it may be faulty and occasion loss of either pressure or gas.

Fire Protection at the Panama-California Exposition

The Seagrave Company, of Columbus, Ohio, has been awarded the contract for supplying the Panama-California Exposition at San Diego, with its fire-fighting apparatus, and has started installation to add to the equipment which has been on the grounds since the construction started. The fire station, of Spanish Colonial architecture like the entire colony of buildings on the high mesa overlooking the sea, was the first structure to be erected, following the administration building and the hospital. Thus far its labors have been light, as the exposition forbade smoking during the construction period and went to other extraordinary precautions to prevent fire.

Several of the big buildings are entirely of steel and concrete, stone and tile. The others are of staff and plaster finish, which in a climate such as that of San Diego, will have a life of thirty years or more, as there is no frost or sudden change of temperature. For this reason as well as for the protection of the valuable exhibits during the year of 1915 there has been close attention to safeguard against fire.



CIVIC ADVANCE

Chicago Municipal Markets

The report of the Chicago Municipal Markets Commission, of which Alderman Jas. H. Lawley, is chairman, gives quite a discussion of the high cost of living, showing from reports of the U. S. Commissioner of Labor the large increase in the last 21 years.

The utter inadequacy of Chicago markets is shown. They consist of the South Water street commission house district, the West Randolph street producer's market, which is mainly wholesale, and the Maxwell street peddlers' market, both wholesale and retail, and mainly foreigners as to customers. There are but few private markets. These markets have no effect on prices to consumers, the prices of retailers running from one-sixth larger to nearly six times as great as those paid to the producers. The average payment by the consumer is divided in the proportion of $1 to the producer, 13 cents for freight, and 77 cents to the middlemen, quite too high an expense of distribution. This expense is shown to be due largely to the speculative system of distribution of farm products thru commission merchants, jobbers, retailers and hucksters, and the excess in the number of men engaged in this distribution. Duplication in hauling to and from central distribution points is another largely unnecessary increase in expense; also loss due to lack of storage facilities and consequent spoiling of perishables. Scattering of railroad terminals is another source of waste, as well as delay in placing of cars.

The commission business is considered out of date. Selling goods wholesale at auction is recommended as advantageous to the producer.

The retail business is done in a very inefficient manner with strong competition and probably twice as many engaged as are needed. Far too many wagons are engaged in delivery, duplication of routes many times over by wagons from different stores being common.

Chicago and San Francisco are the only cities of over 300,000 population which make no expenditures on municipal markets and public scales. The value of land buildings and equipment in the other sixteen cities of that class varies from $713 in Minneapolis, to $7,988,742 in New York, ten of the eighteen cities having more than $500,000 invested.

The summary of the recommendations of the commission is as follows:

1. Chicago's present market facilities are merely private trading centers where middlemen and speculators congregate. These markets, as now constituted, are entirely inadequate, insanitary and extremely wasteful. The city should proceed to formulate plans and proposals for a comprehensive system of wholesale terminal markets under the control of the city, designed to render efficient and satisfactory service to the consuming public.

2. Retail markets should be established by the city wherever private retailers, by excessive and unreasonable prices or an unwholesome food supply, fail to render satisfactory service to the economically weaker part of the city's population.

3. Farmers' markets held in open or covered public places adjacent to centers of population should be established and in such other sections where bodies of consumers may apply for them. These farmers' markets should be made accessible to producers for the sale of articles of fresh garden truck and other staple commodities to the consumer direct.

4. Peddlers, hucksters and push carts are an economic necessity and tend greatly to reduce the high cost of living to the people living in certain sections of the city. Vending of food supplies by these classes should be considered an established and legitimate business and, inasmuch as these classes are able to sell food products to the consumer at greatly reduced prices over the prices prevailing at the retail store, due to the low operating costs of the former, such business as conducted by peddlers, hucksters and push cart men should be encouraged by the municipal authorities.

It has been found that the quality of the food and merchandise sold from push carts in New York City is in the main of as good quality as can be bought anywhere else in the city, and much cheaper. Your Commission believes that a decided service will be rendered to certain classes of our citizenship by peddlers, hucksters and push cart men and that their business should be subjected only to certain necessary sanitary and police regulations and such rules as may be required to prevent undue congestion of vehicle traffic in our streets.

5. Complaint has been made that scalpers have adopted a system of meeting the farmer on his way to the West Randolph Street market in busy seasons at the city limits and purchasing his entire lot of produce. The scalper increases the price of the product at the market and the public has to pay the increased cost. The present ordinance limiting the use of the West Randolph Street market to producers alone should be rigidly enforced.

6. The market hours in the West Randolph Street market should be changed from the present prevailing hours of opening at 10 o'clock a. m. and closing at 2 p. m. from November 1 to May 1 and opening at 4 o'clock a. m. and closing at 10 o'clock a. m. from May 1 to November 1, so that the market hours during the entire year shall be from 4 a. m. until 5 p. m. daily, excepting, Saturday, when the market hours shall be from 4 a. m. until 10:30 p. m.

It has been stated that a large number of consumers at present frequent the South Water Street and West Randolph Street markets daily, and especially on Saturdays, in order to make retail purchases of food supplies at the only places in the city of Chicago where the cost of food is presumably lowest, despite the present unfavorable conditions prevailing in these markets for the making of such purchases at retail.

These hours as recommended, it is believed, will cause the consumer to take an added interest in the public markets at present provided in the city of Chicago and enable him to buy on the markets at convenient hours.

7. An ordinance should be passed by the Chicago City Council requiring all persons, firms or corporations in the city receiving farm produce of any kind for sale on commission to keep a complete record of the amount and kind of such produce received and of the sales made and the prices received, together with the dates of the receipts and sales and the names and addresses of the shipper and purchaser, and that this record shall be open to the inspection of the shipper or the consignor of commodities and to official inspection by the city. Commission merchants should also be required to take out a license from the proper city department and to give adequate bonds of surety for the faithful performance of their work and the sanitary operation of their places of business. Should it be shown that any person doing a commission business in the city has been guilty of fraud, deceit, unlawful practices or conducts his business of handling food supplies in an insanitary manner, provision should be made in the ordinance for the revocation of the license so that such person can no longer carry on a commission business in the city of Chicago. This will serve as an ample protection to the producer and the consumer and will require commission men to deal fairly with both.

8. A city tribunal should be created in the recently established Department of Public Welfare, before which any person may lay a complaint of injustice or unfair treatment incurred in the distribution of food supplies. Such tribunal could investigate all charges made against producers, wholesalers and retailers and will be of invaluable service in investigating any charges that may be made relative to corners in food supplies, combinations in restraint of trade, storage of surplus products by jobbers and other agencies and extortionate prices.

9. In order to give the producer direct access to the markets of the city and to furnish the Chicago consumer with fresher and a more varied allotment of farm products, trolley freight service should be placed in operation over the present existing street railway lines, and the interurban street railways should be given direct access to the city markets and to such other points in the city convenient to the consuming public for the delivery of fruits, vegetables and dairy products. The rapid and easy access to the city markets and to such other points in the city convenient to the consuming public for the delivery of fruits, vegetables and dairy products. The rapid and easy access to the new markets achieved by the establishment of street railway freight service to and from the city will encourage production, and the vast amount of land near the city of Chicago at present undeveloped will be divided into small truck, poultry, dairy and fruit farms. The time has arrived when our urban and interurban street railways should be operated for the benefit of the community in shortening the route between the producer of farm products and the consumer. The carrying of freight by street railway lines inside of the city limits, however, should not be permitted to interfere with the proper handling of the passenger

traffic. Such freight cars should be operated during the hours when the passenger service is at a minimum and practically at a standstill and they should be kept out of the congested district of the city. Freight handled by the interurban street railways could be carried over the Chicago street railways between the hours of 11 p. m. and 5 a. m. without inconvenience to the public. By permitting our street cars to carry freight during the night, street congestion in the day time will be lessened to a large extent by the elimination of a large amount of hauling by teams.

10. It is the sense of the Commission that no private movement for the establishment of improved market facilities in Chicago should be conducted separately from the action contemplated by the city at this time thru the investigation being conducted at present by this Commission. It is believed that no reliable decision conducive to the general public welfare can be made by the classes most directly interested in exploiting a private wholesale terminal market for their own profit. The strategic point to the city upon which the control of its food supply is pivoted is the wholesale terminal market. The entire project under way by the South Water Street merchants for the establishment of such private wholesale terminal market should be held in abeyance pending a careful, adequate and expert inquiry to be made by the Citizens' Terminal Plan Committee of the city of Chicago, the Chicago Plan Commission and the Chicago Municipal Markets Commission for the purpose of devising comprehensive plans and proposals which will serve the future growth and development of the city as a whole and further the best interests of the community.

The Birmingham Water Works Controversy

James Weatherly, one of the city commissioners of Birmingham, Ala., brought suit against the Birmingham Water Company for annulment of its charter on the ground of breaches of its contract, particularly as to the quality of water furnished.

This case was recently decided by Judge Crow, of the Jefferson County circuit court, to the effect that the conduct of the water company did not justify a forfeiture of its franchise. One peculiarity of the decision is that an ordinance purporting to fix rates, under which the company has been acting, apparently under protest, is declared invalid and the company is ordered to go back to former flat rates, which are higher than those at present in use.

The water company has issued two booklets, one giving a review of the entire controversy and a new proposition to the city, dated July 15, and the other a statement to patrons explaining the effect of the recent decision and the rates it requires the company to charge.

The matter has been injected into the campaign for election of a city commissioner, in which Mr. Weatherly is a candidate,

The city engineer, Julian Kendrick, has made an estimate of the cost of constructing an entirely new municipal plant, practically $4,500,000.

The company's proposition proposes a rearrangement of existing contracts whereby the rates will remain as they have been under the ordinance just decided invalid; further reduction will be made in minimum rates and by abolition of charge for making service connections; and provisions for purchase of the plant by the city are made.

It is unfortunate that such questions as this should be used as political capital in election campaigns rather than settled by experts according to their merits on general lines determined, if desirable, by popular vote.

Municipal Notes

Personal Responsibility for Fires

J. O. Hammitt, chief of the Fire Prevention Bureau of New York City, favors the enforcement of personal responsibility for damages from fire, and urges that property owners whose carelessness is responsible for fires should be made to pay at least the cost to the municipality of fighting the fire. Along this line, Mr. Hammitt said, in an address before the municipal officers of New York State:

"Still another thing we have attempted in New York is of special interest to the other cities. Perhaps you know that in some foreign countries a man on whose premises a fire is started is frequently held responsible for the cost of extinguishing the fire and also for damage to the property of others. I do not know exactly how the laws under which this responsibility is fixed in foreign countries are phrased, but we have in the Greater New York Charter a provision under which we think that if a fire occurs or spreads because of the absence of precautions required by law or by lawful orders of the Fire Commissioner, the owner of the premises or person responsible for the violation is liable for the cost of putting out the fire, and for injuries to firemen sustained in fighting it.

"No suit had ever been brought under this section of our City Charter till the present Fire Commissioner, Robert Adamson, went into office. We had a disastrous smoke fire in the cellar of a loft building. It could easily have been extinguished by a single company without danger to the firemen if an order of the Bureau of Fire Prevention for the installation of a sprinkler equipment had been complied with. Because of failure to comply with this order, Commissioner Adamson holds that the Greenwood Cemetery Corporation, which owns the building, is responsible for the cost of putting out the fire; and he has brought suit to recover. We expect to bring suit also for the injuries to the firemen. Perhaps if we succeed it will be clearly established that the Greenwood Cemetery Corporation must indemnify all those who suffered loss in the fire. Once that is established, many people will be more careful."

Dayton Under A City Manager

Dayton, Ohio, completed July 1 its first six months under the commission-manager plan of government, and the city manager has issued a statement of new municipal activities during this period. The report covers only sixteen pages and is exceptional in that it tells only of new work undertaken.

Dayton with 125,000 people expects in 20 years to have a population of 200,000, and is planning accordingly. A sewer system has been outlined with this growth in view and all new sewers are being laid to this program, altho it will take 20 years to complete the system. Water works improvements have been started on which it is proposed to expend $2,000,000 over a period of 16 years. The railroads are preparing a plan for eliminating grade crossings which will take a number of years to carry out.

The manager's report indicates that this new type of government, modeled after that of private business, has brought about some valuable improvements, particularly in the handling of public money. The purchasing division just created shows an average saving of 15 per cent., which will amount to $20,000 during the year. An accounting system has been installed which gives complete control over public property and funds. The annual budget was prepared in accordance with the best modern practice, and expenditures are kept strictly within the appropriations. The eight-hour day has been installed in public works and office employes are required to work the full time. No person from the manager down to the last employe can be paid unless a time sheet has been kept showing the number of hours worked.

In the welfare department the death rate of babies has been cut exactly in two, by adequate health service, the es-

tablishment of free clinics and pure milk stations. Two large parks have been opened to the public with bathing, boating and other amusements. A number of loan sharks have been compelled to revise the schedules to meet legal requirements, and a legal aid bureau established for giving free advice to the poor. Prisoners in the work house are used in the improvement of city parks, community gardens and any other public works, being paroled on their honor. Three women probation officers have been appointed, a school for police has been established, and the methods of the fire and police divisions have been investigated and reorganized.

The Dayton Bureau of Municipal Research has published the manager's report for free distribution.

Transportation Facilities of Buenos Aires

The city of Buenos Aires, now in the million population class, is well covered with electric trolley lines so that it is quite easy to get about. When the new subway between the main centers of business and official activity is supplemented according to plans, the transportation facilities will be almost ideal under the local conditions of traffic.

The accompanying illustration shows a double-decked street car in front of one of the handsome buildings and on one of the well-improved streets which aid in giving it the name of the Paris of America,

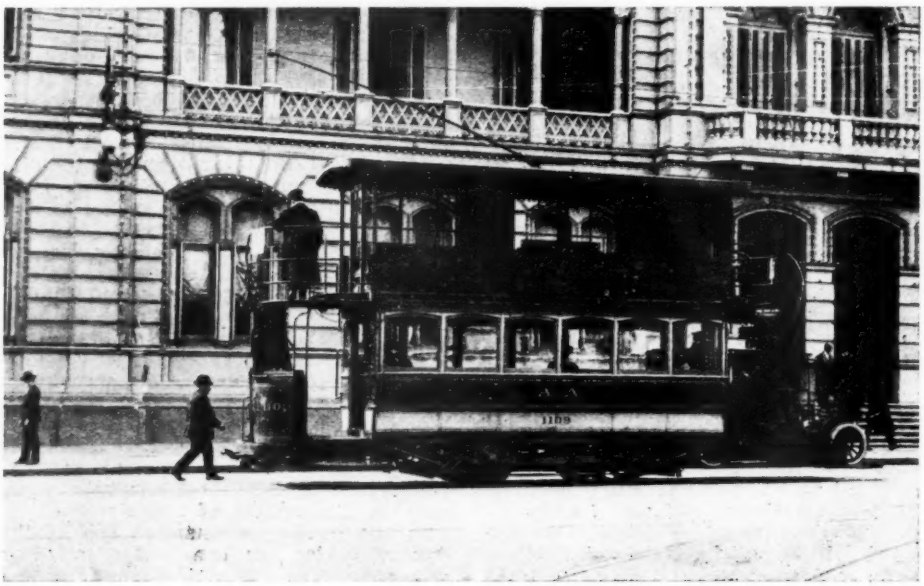
The upper deck is quite as complete a car as the lower, with front and rear entrances and steps, and enables one to take the air and see the city with ease and comfort. Seats are set back-to-back so that the view on one side of the car is unobstructed.

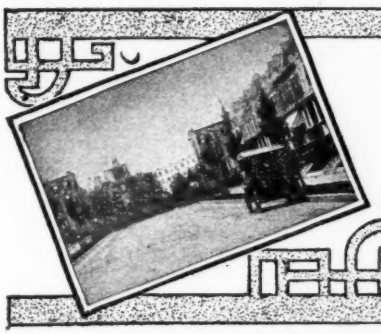
Fares are a pleasurable contrast to most charges in Buenos Aires; about the equivalent of four cents in our coinage will carry a passenger almost from one end of the city to the other.

The facilities which these trolley cars afford are very great indeed, yet, there are times when the pedestrian, especially if he be a stranger to the city, feels that perhaps such ponderous vehicles might be dispensed with. The streets of Buenos Aires are, in general, rather narrow, so that in order to leave room for other traffic, the trolley tracks are often laid within a foot or two of the curb. One might be walking near the edge of the sidewalk suspecting nothing, when suddenly there comes the vigorous clanking of a bell, a heavy rumble, and the huge body of the car grazes the elbow of the wayfarer as it sweeps past.

This, and the further fact that nearly all the streets of Buenos Aires cross each other at right-angles, requires the cars to approach the crossings very carefully in order to avoid accident.

DOUBLE DECK TROLLEY CAR *in Buenos Aires, Argentine Republic. Note also excellence of asphalt pavement.*





MISCELLANEOUS

The Buffalo Brick Convention

On September 9, 10 and 11 the National Paving Brick Manufacturers' Association will hold its annual meeting at the Statler Hotel, Buffalo, N. Y. The business of the convention proper will be completed as early as possible on the 9th and will be followed by a conference with members of the sub-committee of the American Society of Municipal Improvements on standard specifications for brick paving.

Two inspection trips over the new state highways in the neighborhood of Buffalo will be taken on the 10th and 11th, the first to the southeast and south of Buffalo with lunch at the Roycroft Inn, and the second over the largest and broadest brick highway yet constructed, from Buffalo to Fort Niagara, with the afternoon devoted to Niagara Falls. A banquet on Thursday night will bring everybody together.

A number of highway commissioners and engineers have been invited to the convention and those who attended the meeting at Cleveland last year or who have heard of it will be sure to be present this year. The officers and members of the association are princely entertainers and there is no lack of value either technically or socially.

Recent Charter Elections

Several large cities have voted recently on the question of charter revision with various results.

Cincinnati rejected a plan similar in principle to that in use in Boston.

Seattle rejected a plan similar in most essentials to that in operation in Dayton, the principal objection of the voters being to the council elected by wards, with thirty members.

St. Louis adopted its new charter, retaining good principles in its old charter and reducing the men to be voted for to mayor, controller, president of board of aldermen and twenty-eight aldermen. Initiative, referendum and recall are included and non-partisan elections and preferential voting will be subject of a referendum later.

Buffalo has finally secured the passage by the legislature of its charter providing the commission form of government and will shortly vote upon its adoption by the people.

Orange and Irvington, N. J., Bloomington, Ill., Fond du Lac, Wis., Greenwood, Miss., and Palatka, Fla., have adopted the commission form of government; Kansas City, Mo., Collingwood and Kearney, N. J., and Platte, S. D., have rejected it.

Olean, N. Y., Marion and Mulberry, Kan., and Roswell, N. M., have adopted the city-manager plan.

A Much Greater New York

Dr. T. Kennard Thomson, in an address before the Maritime Association of the Port of New York, explained a project shown in the accompanying sketch in which the hatched portions indicate the reclaimed land.

Briefly the scheme advocated by Dr. Thomson involves:

A New East River from Flushing to Jamaica Bays.

A dam at Hell Gate.

A new Harlem River.

Reclaiming the East River from Hell Gate to the Battery.

A new neck of land from the Battery to within a mile of Staten Island.

Tunnel to Staten Island.

A New Bay between Sandy Hook and Staten Island and forty square miles of new land therein.

Connecting these forty square miles by tunnels to Staten Island and Sandy Hook.

Reclaiming the land shown on the Jersey shore.

Developing Newark Bay for a Navy Yard, etc.

The would result in the addition of 100 miles of new water-front for docks, etc.; the reclamation of 50 square miles of land; New York City Hall the center of a greater New York whose radius will

be 25 miles; payment of the debts of the City and State of New York and increase in the prosperity of the whole country.

The rivers and harbors are becoming veritable cesspools. The elaborate plans of the Metropolitan Sewerage Commission are designed, not to improve the present conditions, but to prevent them becoming very much worse.

The proposed plan will make it possible to run great trunk sewers from White Plains down where the East River now is, thence to Staten Island, picking up all the Jersey sewage, and then on, beyond Sandy Hook, where it can be properly treated.

Magnificent opportunities would be created for Jamaica Bay when it is in direct touch with New York. Staten Island will be put in direct contact with New York; and also with a new and 'Really Greater Pittsburgh,' as this new territory may well be termed, of 40 square miles, with the most magnificent harbor in the world, with all the thousand-foot wharves required and plenty of room for dry docks, repair and ship building shops and all kinds of crafts.

With the new Barge Canal ore can be obtained here as cheaply as in Pittsburgh, making it possible to compete with the world in the manufacture and export of all kinds of goods.

This would permit all the railroads to reach Staten Island, Manhattan, Brooklyn, Queens, etc., quicker and cheaper than they can now reach New Jersey.

In common with other engineers Dr. Thomson considers the project one of finance, the engineering difficulties being but matters of detail.

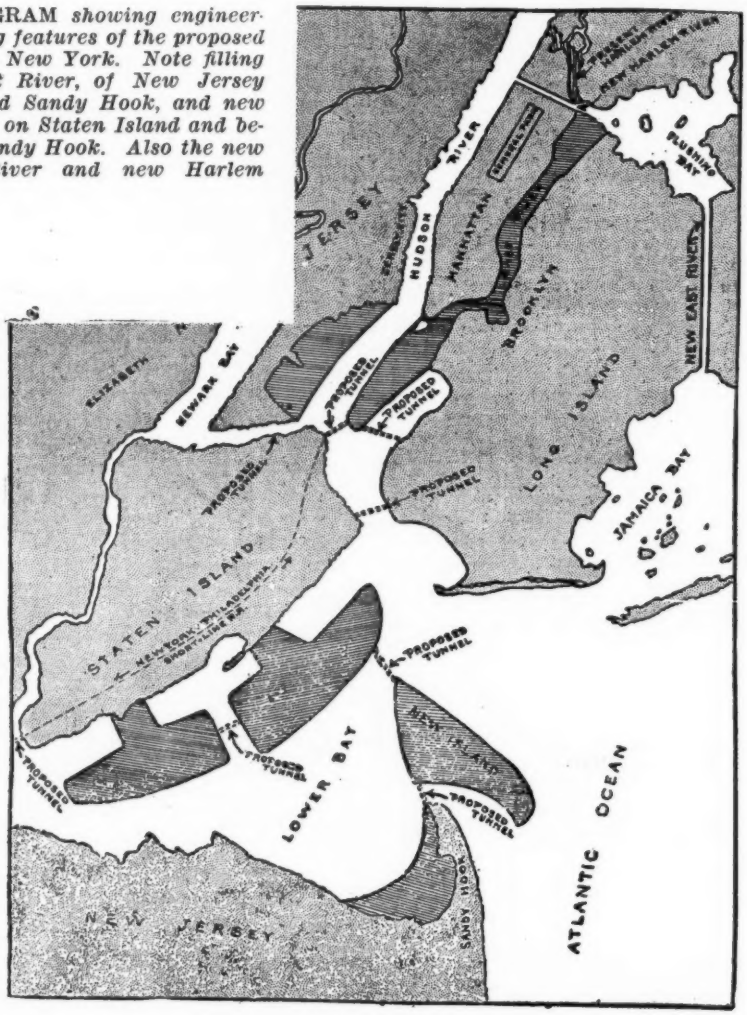


DIAGRAM *showing engineering features of the proposed Greater New York. Note filling of East River, of New Jersey flats and Sandy Hook, and new harbors on Staten Island and behind Sandy Hook. Also the new East River and new Harlem River.*

Trade Opportunities In Other Countries

The *Daily Consular and Trade Reports*, issued by the Bureau of Foreign and Domestic Commerce of the U. S. Department of Commerce, at Washington, D. C., publishes many reports, telegraphic and mail, of opportunities for the sale of goods from the United States in South America or Latin America which are indications of the serious conditions under which those countries are suffering thru the withdrawal of their usual supplies from England, Germany and France, and the consequent search for new sources of supply.

In the light of recent occurrences on this continent which have caused a stronger tendency of American nations to get together, it is natural that these countries should look to the United States for what they want, and that they should take what this country has whether it is exactly what they are accustomed to or not. It is up to our merchants and manufacturers to take care of this trade, which is actually being forced upon them.

The *Daily Consular and Trade Reports* can be subscribed for at $2.50 a year, thru the Superintendent of Documents, Government Printing Office, Washington, D. C.

An appropriation of $50,000 for promoting commerce in Central and South America, the first of the kind, was available July 1 and will be used to reinforce the existing service. Trained agents will study markets for lumber products, hardware, clothing and accessories, and the Gulf of Mexico and Carribean Sea in general. Another appropriation for commercial attaches enables the appointment of promotion agents for the larger ports, Rio de Janeiro, Buenos Aires, Santiago and Lima.

Publications of the Department are obtainable of the Superintendent of Documents, such as the South American Trade Directory and bulletins on many special subjects, in addition to the daily reports mentioned.

Convention of American Society of Municipal Improvements

The American Society of Municipal Improvements will hold its annual convention at the Somerset Hotel, Boston, Mass., on October 6 to 9, with the usual meeting of the Committee on Standard Specifications and the sub-committees on the various paving and sewer specifications on October 5 at 10 o'clock a. m.

The program will be ready for issue in a few days and promises to be more than usually valuable. Advance copies of papers or abstracts will also be issued. These include the following thus far:

"Hints Leading to Good Budget Making for Municipalities," by Wm. Thum, former mayor of Pasadena, Cal.

"Economics of Sewage Filters" and "Limitations of Water Filters," by George W. Fuller, consulting engineer, New York City.

"Municipal Ownership and Operation of Electric Utilities on the Pacific Coast," by C. Wellington Koiner, engineer and superintendent of the municipal electric light and power plant at Pasadena, Cal.

"Street Cleaning," by Edward D. Very, sanitary engineer, New York City.

"The City Efficient," by Louis L. Tribus, consulting engineer, New York City.

"The Effect of Leaking Gas on Bituminous Pavements," by George C. Warren, Boston, Mass.

"The High Temperature Incinerating Plant at Savannah, Ga.," by E. R. Conant, chief engineer of the city.

"The Remodeling of a Small Sewage Disposal Plant at Morristown, N. J.," by Alexander Potter, consulting engineer, New York City.

"Fire Prevention," by J. C. McCabe, boiler inspector, Detroit, Mich.

"The Experimental Sewage Disposal Plant of Brooklyn, N. Y.," by George T. Hammond, engineer in charge.

"Napped, Reclipped, Grouted Granite Block Pavements, the Ideal Economical Pavement for Heavy Traffic Streets," by William A. Howell, engineer of streets, Newark, N. J.

"Recent Tendencies in City Charters," by Nelson P. Lewis, chief engineer of Board of Estimate and Apportionment of New York City.

"Small Parks," by C. D. Pollock, consulting engineer, New York City.

"The Bleeding and Swelling of Long Leaf Pine Paving Block," by Clyde H. Teesdale, in charge of wood preservation, U. S. Forest Products Laboratory, Madison, Wis.

Papers are also promised by I. S. Osborne, in charge of the garbage reduction plant at Toronto, Ont.; S. A. Greeley, civil engineer, Winnetka, Ill.; G. A. Parker, superintendent of Keeney Park, Hartford, Conn.; E. A. Fisher, consulting engineer for Rochester, N. Y.; E. L. Dalton, Dallas, Texas; Norman S. Sprague, superintendent of construction, Department of Public Works, Pittsburg, Pa.

Committee reports on Street Traffic, Fire Prevention and Standard Forms will appear in the advance copy and others are promised. Several of the sub-committees on standard paving specifications are preparing suggestions of changes and additions to the adopted specifications for the purpose of bringing the specifications of the amalgamated A. S. M. I. and A. S. P. S. into complete accord.

But two of the sessions of the convention will be devoted to entertainments and these, in the hands of the local committee, will be instructive as well as entertaining. Charles Carroll Brown, 702 Wulsin Building, Indianapolis, Ind., is secretary, and Joshua Atwood, Boston, Mass., is the chairman of the local committee.

Technical Associations

The Mid-West Cement Show and Convention of the Mid-West Cement Users Association will be held in Omaha, Neb., Auditorium, March 2 to 6, 1915.

The Illuminating Engineering Society will meet at the Hollenden Hotel, Cleveland, O., Sept. 21 to 26. In the long list of papers to be presented are the following of special interest to our readers: "A New Standard Light Source," by L. A. Jones; "Characteristics of Gas-Filled Lamps," by G. M. J. Mackay; "Recent Improvement in Gas Lamps."

The Federation of Trade Press Associations will meet at Congress Hotel, Chicago, Ill., Sept. 24, 25 and 26. E. E. Haight, Secretary, Chicago.

The Thirty-third annual convention of The New England Water Works Association will be held in Boston, Mass., Sept. 9, 10, 11, 1914, at the Copley-Plaza Hotel. The Committee of Arrangements have endeavored to make this convention of particular value to water works superintendents. The program of papers to be presented includes subjects of live interest to the man who is responsible for the daily maintenance and operation of water works. In addition to the reports of committees, which are always valuable features of these conventions, there will be papers on the construction of dams, electrolysis, allowable leakage from water mains, lessons from the Salem fire, the automobile as an efficiency agent in water works management, boiler house troubles, water uses difficult to control, care of gates and hydrants, metering an old city, the Miraflores water purification plant, machine calking of lead joints, public watering stations, low water consumption in Milton, use of the magnetic dipping needle in locating pipes and gates.

The Ohio State Highway Department, the U. S. Office of Public Roads, the Ohio Good Roads Federation and the Highway Pageant and Exhibits Committee co-operate in a pageant and exhibition at the Ohio State Fair in Columbus on Sept. 1, 2, 3 and 4. Five of the models shown by the Government department are shown before shipping to the Panama-Pacific Exposition.

The special committee of the American materials for road construction and standards for their test and use, is distributing a form of report of data concerning the use of bituminous materials in surfaces Society of Civil Engineers on bituminous and pavements to engineers having charge of bituminous road surfaces and bituminous pavements, asking for the following items of general information: State, county, town or city, highway, contractor, length of work, width of metal (average), date of beginning, date of completion (of use of bituminous materials), method of construction (state character of foundation, thickness of courses, kinds and quantities of road metal and of bituminous materials used, methods used, and approximate maximum grades). (Attach copy of specifications if available.) The committee would like to have responses from all engineers having such work in charge, whether they receive the blanks directly or not.

The official call for the fourth American Road Congress to be held at Atlanta, Ga., Nov. 9 to 14, has been issued by the American Highway Association and forty-eight other good roads associations and other organizations interested in good roads. A preliminary program is also issued, which can be obtained of I. S. Pennypacker, executive secretary, Colorado building, Washington, D. C., or of the local executive committee at Atlanta, Ga. The government exhibit will be a feature and will include a remarkable series of models showing every type of road construction from the military roads of Imperial Rome down to the most modern types of market road and city boulevard. Reproductions of the roads built by the French Bourbons, by Napoleon, as well as the early specimens of macadam road built by John L. Macadam, will make the series historically complete. This exhibit, which is now being prepared by the U. S. Office of Public Roads, will also include a dynamometer equipment, by means of which the exact pull required on every type of road service can be shown with mathematical accuracy.

The Society for Electrical Development, of which J. M. Wakeman is general manager, has on its board of directors members representing central stations, manufacturers, jobbers and contractors, four of each, with four representatives at large. Members of the first two classes pay dues equal to one-fifteenth of one per cent. of annual business and of the last two, one-twentieth. The society has a number of experts in the field who work upon the development of the uses of electricity, aiding local members when desired. New business getting, better specifications, motor drives of machine tools, household uses of electricity in heating, cooking and running various apparatus, including refrigeration and ventilation, devices for advertising in all lines and by all methods, window display light-

ing, store lighting, are a few of the lines in which these men are employed.

The Panama-Pacific International Exposition has issued a handsomely illustrated booklet of the exposition in color, well worth asking for. The Engineering Congress will be held Sept. 20 to 25, 1915.

The eighteenth annual convention of the Central States Water Works Association was held at Wheeling, W. Va., Aug. 25, 26 and 27, 1914, with an interesting program. R. P. Bricker, secretary, Shelby, Ohio.

Technical Schools

The latest addition to the curriculum at the Massachusetts Institute of Technology is the establishment of courses in highway engineering in the Department of Civil and Sanitary Engineering, under the general supervision of Professor Charles M. Spofford, head of the department, the instruction in highway engineering being given by Professor Hector J. Hughes, who comes from Harvard.

Personal Notes

The H. B. Pullar Co., of Detroit, Mich., have been retained by the Michigan State Highway Department to supervise the construction of an open-specification type of asphaltic concrete pavement on an extension of the Wayne county concrete road on Woodward avenue, Detroit. This road was improved with bituminous macadam, penetration method, and did not resist the traffic on the road successfully.

E. St. Elmo Lewis is vice-president and general manager of the Art Metal Construction Co., Jamestown, N. Y., from Sept. 1.

Alexander Potter, consulting engineer, New York City, has been retained by the government of Cuba to investigate on behalf of the Secretary of Public Works, the completed construction on the sewerage system now in progress and to pass upon a project for the enlargement of the water supply of Havana.

Wilbur Allan Ginn, formerly of Columbus, O., in his work as engineer of street and highway improvements in Florida, has adopted what he calls auto corners, being circular curb corners with 25-foot radius, about which he claims an automobile can turn at twenty miles an hour. He has promised some photographs of streets so built and some data on building pavements on the sand base universal in Florida, as the vibration, variations of grade of brick paved streets and their cause and method of prevention, in the state which is not troubled with freezing of the soil.

C. M. Foster, formerly secretary of Meacham and Wright Company, Chicago, dealers in building materials, is appointed district manager for the Edison Portland Cement Company at Philadelphia, vice J. T. Wakeman, transferred to New York.

Roger L. Morrison, highway engineer with the United Gas Improvement Company of Philadelphia., M. A., Columbia University graduate course in Highway engineering, has been appointed professor of highway engineering in the Agricultural and Mechanical College of Texas.

Civil Service Examinations

The U. S. Civil Service will hold examinations at the usual places as follows:

September 8: Expert Radio Aid at Naval Radio Station, Radio, Va., at $10 a day; and September 16 for same at $6 a day at New York navy yard; and $8 or $6 a day at navy yards at Boston, Philadelphia, Norfolk, Charleston, and Puget Sound.

Publications Received

Effective Voting, an article on preferential voting and proportional representation by C. G. Hoag, general secretary of the American Proportional Representation League, has been published as Document No. 359 of the U. S. Senate, second session of Sixty-third congress. The league has issued its pamphlet No. 5 giving testimony from abroad.

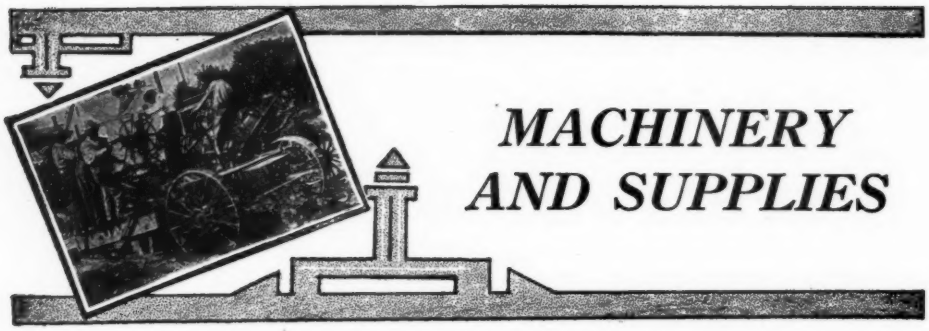
An addendum, being a reprint of the five chapters on Modern Road Construction in Boorman's "Asphalts," 1914 road edition ($2), is published in paper by The William T. Comstock Co., New York, for 25 cents. These chapters are additions to former editions of Mr. Boorman's book.

Bulletins 4, 5 and 6 of the Illinois Coal Mining Investigations describe and illustrate coal mining practice in Districts VII, I and V of that state. They are by S. O. Andros and are published by the University of Illinois, Urbana, Ill.

"The Evolution of Bitulithic and Warrenite for Street and Road Surfaces," a paper presented to the Washington Good Roads Association at North Yakima, Wash., by Walter B. Warren, M. E., Vice President of Warren Brothers Company, Boston, Mass.

Water-Supply Paper 345-E of the U. S. Geological Survey gives a method of determining the daily discharge of rivers of variable slope, by M. R. and W. E. Hall and C. H. Pierce.

James R. Marker, State Highway Commissioner, is editor and publisher of the "Ohio State Highway Department Monthly," begun in February, 1914, and distributed thru the state without cost by the educational bureau of the department in Columbus.



MACHINERY AND SUPPLIES

Water Meter Simplicity

The simplicity of the disk meter, the strength of a special annealed malleable iron or the special hard tough bronze casing, the protection from corrosion by dipping casing in a hot galvanized solution, the protection from frost by the use of a soft gray galvanized cast iron bottom which breaks at 600 pounds, are the principal talking points of the Badger water meter.

The last point mentioned is termed the "big idea" and the breakage of the small and very inexpensive cast-iron bottom saves the delicate and more expensive mechanism of the meter itself from injury by the expansion of the ice when the meter is so set that it freezes in cold weather. The bottom can be replaced for a few cents and is conveniently done by four toggle bolts. The remainder of the meter case and the meter mechanism will continue to operate properly without adjustment.

Thru the removal of the bottom by loosening the toggle bolts it is easy to get at the interior to replace the disk when worn out or to examine, clean or repair the operating mechanism. A light rap on inlet or outlet end of the housing releases the complete working parts for inspection. As 90 per cent. of the troubles with disk meters are found in the disk or measuring chamber this ease of removal is invaluable, especially since the repairs can be made on the spot, thus obviating the delay and expense of taking the meter to the shop and dismantling it.

The interior parts are of phosphor bronze. The housing is so constructed that the current of water completely fills the receptacle both above and below the measuring mechanism, thus keeping the chamber flushed and free of the sediment which deposits in blind pockets or partly filled spaces.

This description applies to the smaller sizes, 1-inch or less. The larger sizes have heavy cast-iron casings thoroly dipped in a non-corrosive coating compound.

That the meter has justified the claims made for it is evidenced by the fact that so many cities are using them in large quantities. Kansas City, Mo., installed 500 Badger meters in 1910, 2,000 in 1913, 2,500 in 1914. Milwaukee has installed 85 to 90 per cent. of its new meters with the Badger. Lorain, O., after installing 500 in 1912 has bought 50 at a time without advertising and uses no others. Manitou, Mich., Mason City, Ia., Scottsville, Mich., Oregon, Ill., use no others, the latter city having 900. Chicago bought 1,000 of ⅝ to 2-inch sizes in 1913. A part of the recent large purchase of meters by Portland, Ore., was of the Badger kind. North and west are well covered with Badger meters, indicating their special popularity in climates subject to very cold weather, where it is sometimes styled the meter minus the troubles.

The Badger Meter Manufacturing Co., 261 Third street, Milwaukee, Wis., are the makers and will supply full information and prices.

Goodyear Tires at Ante-Bellum Prices

The Goodyear Tire & Rubber Co. announce "No war prices on Goodyear Tires." Mr. F. A. Sieberling, president of the company, thus explains their unique position.

"We advanced Goodyear prices, as others did theirs, when the rubber panic came. Almost in a day crude rubber rose in New York from 55 cents per pound to much over a dollar. And, as most of the world's rubber comes via London or Antwerp, we saw no way out for a time.

"The New York supply was too small to consider. European exchange was entirely suspended. Merchant ships had ceased running.

"But we have an almost world-wide organization, and we brought it at once into play. We are the world's largest buyers of high-grade rubber, so we have our own experts in London, Colombo, Singapore and Para.

"We cabled our London people to buy up the pick of the rubber there. By acting quickly and paying cash they obtained 1,500,000 pounds of the finest rubber there. They bought before the advance—before the other buyers saw a way to get London exchange or to bring the rubber here.

"That big supply of rubber is now nearly all on the way to the Goodyear factory in Akron. It constitutes the best of the London supply. On the inferior grades remaining, prices have since been rapidly advanced.

"We have since taken other steps to insure us a continuous supply, all of the highest grade rubber. In all the chief sources of rubber supply we have experts on the ground. All is being done that can be done to secure the best rubber, the exchange to pay for it and the ships to bring it here.

"The result is that Goodyear tire prices are now the same as in June. We are using the same grade of rubber and the same amount of it as we always have used in these tires.

"We are running our factory with three shifts of men, twenty-four hours a day. So long as we remain in this fortunate position on rubber, we shall supply tire users at before-war prices to the limit of our capacity."

Using the Motor Truck

This interesting illustration brings out some of the possibilities of the motor truck. The Bridgeport Hydraulic Company in building a 4,500,000,000-gallon reservoir at Bridgeport, Conn., faced the job of moving a contractor's locomotive to the scene of the construction work. The picture shows how it was done.

This construction company owns four of these trucks and each one of them has been called on frequently for novel service. The locomotive in the above picture weighs 15 tons. The wagon on which it rests weighs 3 tons, and the truck itself is loaded with 5 tons of rock to give it traction. The locomotive was too big and heavy to put directly on the truck body, so this massive wagon was called into service.

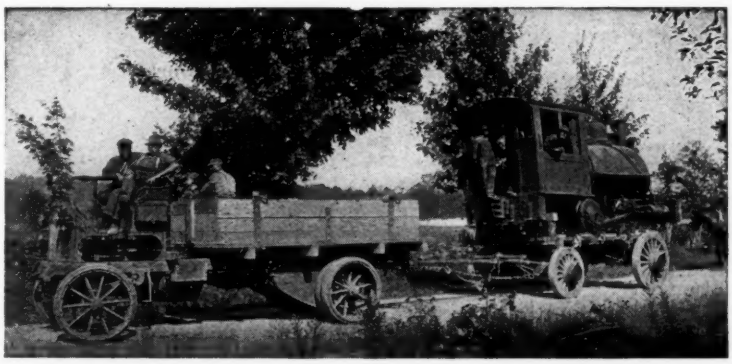
After delivering the locomotive, these trucks hauled all the cement, machinery and supplies for the construction of this reservoir, besides carting 5 miles of 48-inch iron pipe, every section of which weighed 5 tons. No small credit for this performance is due Goodrich Wireless Truck Tires. These trucks effected a 40 per cent. reduction in costs compared with horse-traction haulage.

Metallic Tape Threader

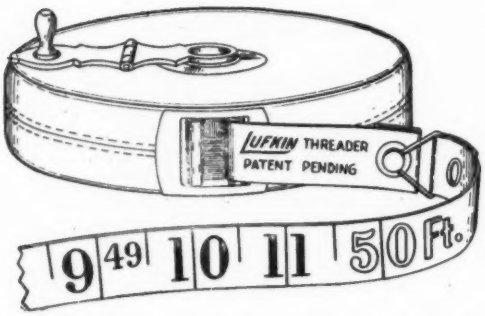
The Lufkin Rule Company (factories at Saginaw, Mich.) have just put out a patented measuring tape attachment, known as a "threader," which will hereafter be furnished with their metallic woven tapes without extra charge.

The threader is a loop and stud arrangement, by means of which the tape, tho securely fastened to the winding drum of the case when in use, can yet be readily detached from it and a new tape as readily attached, no manipulation of the case, case screw or drum being required to do this.

Woven tapes are sometimes torn by accident, or thru long use become soiled and worn in such a way that they must be replaced while the case is yet in very fair condition. The case not receiving the same hard use as the tape line, outwears it, and representing approximately half the value of the outfit, it is of considerable importance that it be a simple matter for anyone to insert a new tape in the old case as often as necessary and thus get the fullest measure of use out



CONTRACTORS LOCOMOTIVE *hauled by motor truck from railroad to location of construction work.*



of the case as well as the tape. Metallic tapes without cases are quite generally stocked by hardware houses, etc., and can always be easily obtained. The attaching is perfectly and easily accomplished by means of the threader.

The Toledo Water Works Have A New Large Pumping Engine

A new high-power water pump, with a capacity of 30,000,000 gallons a day, built by the Allis-Chalmers Co., was recently installed under the supervision of Mr. Wayne W. Mackey, erecting engineer of the company, at the Broadway pumping station of the water works of Toledo, O. It has the distinction of being one of the greatest pumping engines of its class ever constructed, and cost $83,000.

The pump is of vertical triple-expansion design, and the cost of operation is estimated as one-sixth of the cost of maintenance of the original 5,000,000-gallon pumps formerly used. It will increase the water-providing capacity of the Broadway station to 72,000,000 gallons daily. Toledo's normal daily supply is less than half of this amount.

All of the cylinders, heaters and steam lines connected with this giant pump are insulated with J-M coverings furnished by the H. W. Johns-Manville Co. The work was done by the contract department of their Cleveland branch. The cylinders and heaters are covered with 1½-inch J-M 85 per cent. magnesia blocks, finished with ½-inch cement. The high pressure cylinders are insulated with 2-inch magnesia blocks and ½-inch cement. All steam lines are protected with J-M 85 per cent. magnesia pipe covering.

The Toledo authorities expressed themselves as well pleased with both the work of the big pump and the appearance and character of the insulation.

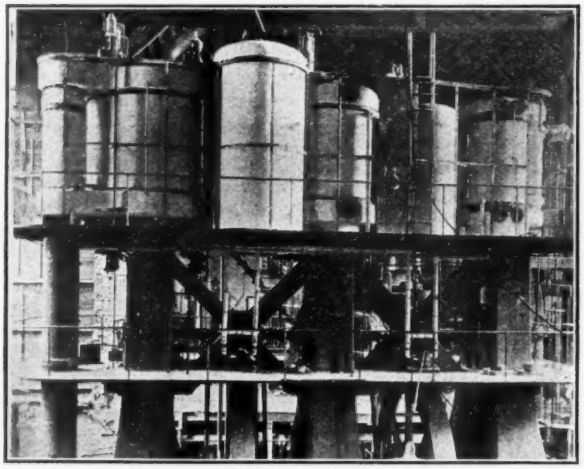
Street Railway Repair Automobile Truck

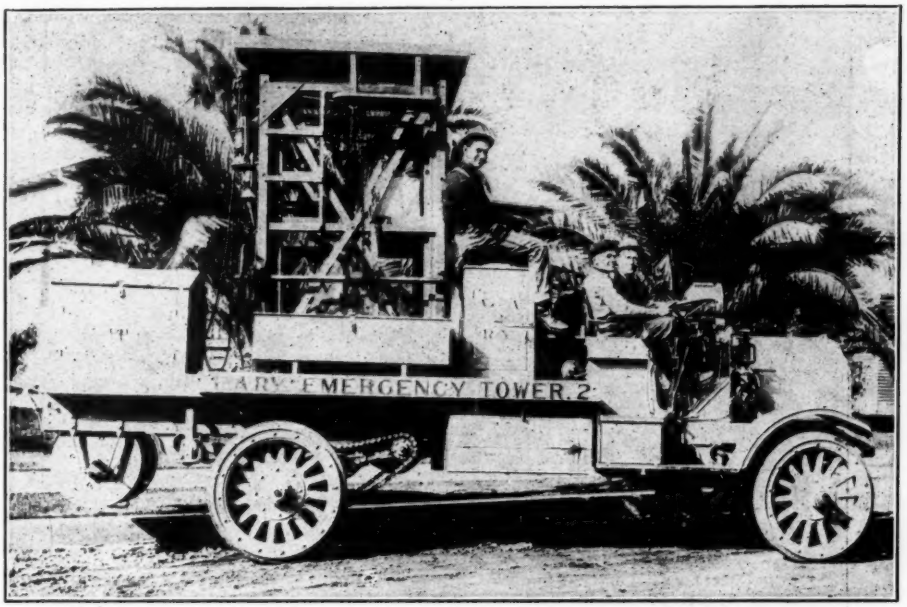
The Kissel tower truck has given the best service of any of the machines used for trolley repair work by the Los Angeles Railway. If a truck is not built right the swaying of the tower and constant running of the engine will rack it all to pieces. The Kissel has been in service about three years. The present daily mileage varies between 8 and 38, with an average around 24. The total mileage since purchase is over 16,000, and the engine has run the estimated equivalent of three times this. Sometimes the engine runs 20 hours out of the 24.

The car is taken out in regular day service at 7 a. m. and the engine runs until 12, then off until 1 p. m. and running from then to 5:30. The crew telephones to a dispatcher on completion of each job and gets instructions for the next. The engine has to be kept running so the truck can be moved off the track to let a trolley car thru whenever required.

The car is used by the night crew for emergency calls, and when there are many of these succeeding the day use, the engine gets a long and severe try-out but has never "boiled." The record of repairs shows that the hard service has worn out one bidy and tower, which have been replaced. The engine has been overhauled in the railway company's shop and a new set of timing gears, new set of push rod guides, and new differential gear provided after about 13,000 miles

NEW THIRTY MILLION GALLON *pumping engine of the water works of Toledo, O.*





of service. These repairs were due to natural wear, and not to any defect in material or design.

The car has had a good many drivers and of all kinds. The attempt is made to prevent overspeeding, and the car is now equipped with a Jones recording speedometer which makes possible a definite supervision. Ordinary running is at 12 to 15 miles per hour and if speed exceeds 18 miles an explanation must appear on the report. If the driver has no emergency to justify overrunning he is hauled over the coals severely.

The trucks of other high grade makes have not stood up as well as the Kissel. One having a three-point suspension shook out many rivets, and required frequent repairs to the engine. All bearings had to be replaced, and the three point suspension taken out and a solid subframe installed. The Kissel has never had to have any bearings replaced. This is an important comparative demonstration of Kissel reliability.

Upkeep cost on the Kissel, which is now in first class serviceable condition, has been about one-third that of another truck in similar service.

How to Make A New Lawn

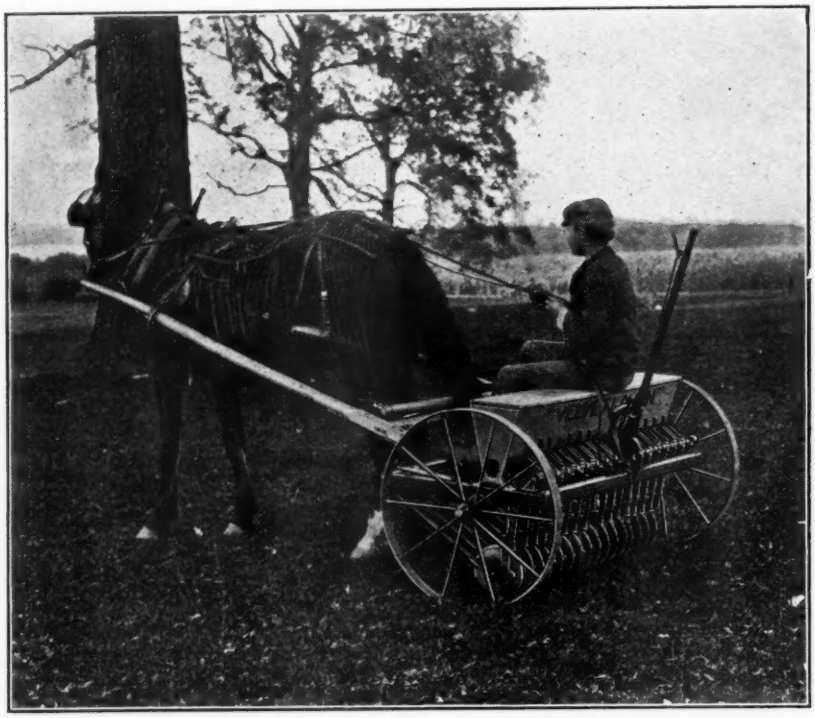
Prepare the ground as soon as the weather permits and sow the seed (the Velvet lawn broadcast sower is recommended) in March or April, or, should it be a severe season, sow during the early days of May.

It is always good policy to allow as much time as possible in which to prepare the ground. A month or six weeks is not too much, as the surface will, to a certain extent, find its own level, which can more easily be corrected at the time the seed is sown, that is, if the "Velvet-lawn" broadcast sower is used, for the cultivator attachment on the rear of the machine was constructed for this purpose.

When the work is done in a hurry it is generally badly done, as it gives no chance for the surface to consolidate, which is so essential for the welfare of the young grass plants, or for quick-growing weeds to assert themselves and be destroyed before the grass seeds are sown.

The making of a new lawn can roughly be divided into five operations, viz: Dig-

HAND POWER SEEDER *for use on putting greens and small city lawns.*



HORSE-DRAWN SEEDER *for use on large lawns and grass areas.*

ging, manuring, preparing the seed bed, seeding and after treatment.

Dig to the depth of a spade, turn the soil well over, break up the large clods, pick out all large stones, roots, etc. Grass being a shallow-rooted plant makes it quite unnecessary to work the soil to a greater depth, unless the old turf is to be buried, then the surface should be turned over to a depth of two spades.

In most cases the results will be better and quicker if the soil is manured.

The best general manures for digging in are fresh peat moss, stable manure, and old well-rotted short straw. These manures should be spread over the surface at the rate of one load per 100 square yards, and forked or dug into the soil in such a way that the bulk of it remains within 2 or 3 inches of the surface. Some people maintain that manure, if used, should be buried at least 6 inches deep, while others hold that it should not be used at all, otherwise the grass will grow coarse and rank.

It has been proved over and over again that the closer the manure is kept to the surface the better and quicker are the results, because the young grass can reach it quickly and receive the desired help where it is most required, that is to say, during the early period of its existence, whereas, if it is buried deeply it will take months for the roots to reach it, and it is quite possible, and it often happens, especially during unfavorable seasons when grass grows very slowly, for it to perish for want of manure, in spite of the fact that plenty has been put in the ground, but out of reach.

The suggestion that manure makes grass grow coarse and rank is another fallacy; if a mixture of coarse grasses is sown a coarse turf will be produced, but if a mixture of the finest grasses is sown a turf of the finest quality will be produced.

Prepare the seed bed by breaking up the clods, removing large stones, and all weed roots with the cultivator attachment on the sower; then roll the ground with a "Velvetlawn" roller until the surface becomes quite firm, true and fine, and, when walked on, hardy shows the imprint of the foot.

Seeding is the most important operation in the making of a new lawn or green, because, no matter how good the soil or seed may be, the results will be both better and quicker if the seed is deposited into the ground.

The "Velvetlawn" seeder or sower makes it possible to sow any time—wind

or no wind. Put your seed in the ground when the conditions are right. Heavy rains cannot wash the seed away, neither can birds eat it. The seed is deposited into the soil to a depth not exceeding one-fourth of an inch. The ground should again be rolled and cross-rolled with the "Water-Weight" roller.

The young grass should appear above the ground in about 14 to 21 days if spring sown, according to the weather. When about 1 inch high it is greatly benefited by an application of prepared compost or fertilizer. These top dressing materials are very gentle in action, they do not burn the young grass, but they protect it from extremes of temperature and assist to conserve moisture.

When the young grass is about 1½ inches high it should be rolled with a "Water-Weight" roller, and when about 2 inches high it is ready to be cut. It is most important to regularly mow and roll the young grass from the very start, otherwise it will grow long and thin, instead of branching or "stooling" out and covering the ground.

The seeders and rollers are made by the Velvetlawn Seeder Company, Springfield, Ohio.

Parcel Post Carried on Diamond Tires.

Uncle Sam's parcel post automobiles all over the country now are running on Diamond tires, which won the government's award recently.

The expansion of the parcel post field to include heavier shipments than were originally planned brought the post office department face to face with the problem of automobile transportation. In many cases good sized trucks are used to handle the great variety of goods which the new post office system carries.

Diamond tires were chosen on the basis of quality and price. The Diamond ability to do hard work with least wear, coupled with the Diamond prices, brought the award.

Kissel Trucks in Los Angeles Water Department

Two 1,500-lb. Kissel trucks have been in use since some time in 1912 for meter service of the Los Angeles Water Department. These cars are worked daily with a crew of two men changing meters, etc. Loads are light in proportion to the capacity of the trucks, the requirements of the service limiting them to not over 600 lbs. The service rendered is high in point of mileage when the number of stops per day is taken into consideration. Seldom does the number of separate jobs which the use of this car enables its crew to handle fall below forty. The number is usually much higher, frequently running close to 100, and the crew boasts of one day when they gave decisive proof of their own efficiency and that of their truck by clearing up 125 jobs. As the truck is standing while work is being done, and mileage per day averages about 40, it is apparent that between jobs high speed running is indulged in to an extent rather unusual in commercial vehicle operation. This is admitted by officials of the department.

A 2-ton Kissel is used in connection with installation of big meters and services. It is usually loaded close to capacity, and carries a crew of four men. As not more than a dozen jobs, and sometimes only one of this type can be handled in a day, the car has much standing time.

All repairs necessary are made in the department's shop. The cars have required very slight attention, and are considered to be in as good serviceable condition as when new.

The department also operates three Kissels of the pleasure car type.

The city of Riverside is using Kissel trucks in water department service.

Trade Publications

The C.-A.-Wood-Preserver Co., St. Louis, Mo., is distributing a broadside "warning to the users of wood preservers," accompanied by a diagram showing comparative evaporation of coal-tar creosote and C. A. wood preserver.

A "Statement to the Common People" about septic tank satisfaction is made by the Ashley House-Sewage Disposal Co., Morgan Park, Chicago, Ill.

The Milwaukee Conduit and Insulation Co., Milwaukee, Wis., issues a booklet descriptive of a patented "Portland sectional conduit" of vitrified glazed tile.

"Iron Roofs That Resist Rust," "A Journey to Armco Farm," and "Defeating Rust" are three recent pamphlets of the American Rolling Mill Co., Middletown, O., detailing the uses of American ingot iron.

The Keystone and Eureka water meters are fully described and illustrated in a new booklet issued by the Pittsburg Meter Co., East Pittsburg, Pa.

A Second Plea for Publicity in the office of County Treasurer of Cook County, Ill., is made in a 12-page pamphlet by the Chicago Bureau of Public Efficiency.

Proceedings of the Twentieth annual convention of the American Society of Municipal Improvements, held at Wilmington, Del., Oct. 7-10, 1913. Charles Carroll Brown, secretary, 702 Wulsin Bldg., Indianapolis, Ind.

CONTRACTING NEWS

AUTOMOBILES—FIRE APPARATUS.

BIDS REQUESTED.

Cincinnati, Ohio—September 1, until noon, bids will be received for one 4-cylinder 5-passenger touring car of 30 to 35 h.p. Ernst Von Bargen, city purchasing agent.

Eremont, Neb.—September 14, until 8 p. m., bids will be received for one automobile combination fire truck, equipped with chemical tanks, extension ladders, roof ladders, lanterns, searchlights, headlights and all other necessary equipments. Certified check, $200. John Gumb, chairman Board of Public Works.

St. Bernard, Ohio—September 5, until noon, for 1,000 feet double packet standard or two-ply multiple 2½-inch fire hose. Address director of public safety.

CONTEMPLATED WORK.

Delphos, Ohio—Purchase of auto fire truck being considered. Mr. Westrich, fire chief.

Hamtramck, Mich.—Bond of issue of $58,000 voted for fire department equipment and buildings. Motor-driven apparatus will be installed, consisting of one engine, one combinational chemical and hose cart and ladder truck. John C. Schultheis, village clerk.

Jersey City, N. J.—Purchase of following equipment being considered: Two motor-driven pumping engines, cost $20,000; two motor tractors for fire engines, cost $8,500; two aerial trucks, cost $22,000, and installation of fire alarm boxes, to cost $2,500. Frank Hague, director of public safety.

Lorain, Ohio—Bids for motor aerial fire truck rejected and new proposals called for. Appropriation $10,000. J. J. Pollock, mayor.

Portland, Ore.—Bids will be asked shortly for 13,650 feet fire hose. Mr. Albee, mayor.

San Marcos, Tex.—Bond issue of $20,000 voted for fire department equipment.

FOREIGN TRADE OPPORTUNITIES.

No. 13517—Automobile Supplies—Local importer desires to act either as agent on commission basis, or represent in certain territory American manufacturers of automobile supplies.

No. 13556—Cycle Car—South African business man desires to secure agency rights for an American cycle car suitable for that country. Car must be right-hand drive, good clearance and moderate in price.

No. 13558—Motor Car and Motorcycle Accessories—South African firm desires catalogs, price lists of motor cars, motorcycles and cycles. Address may be obtained from Bureau of Foreign and Domestic Commerce, Washington, D. C.

Addresses omitted may be obtained from Bureau of Foreign and Domestic Commerce at Washington, D. C.

BRIDGES.

BIDS REQUESTED.

Anderson, Ind.—September 11, until 10 a. m., bids will be received for following bridge work: Single span, 140 feet long, over White River at Twelfth street, this city; creosote block floor and painting bridge over Mud Creek, West Washington street, Alexandria, Ind.; creosote block floor, painting and other repairs on bridge over Pike Creek, South Harrison street, Alexandria; creosote block floor, painting and other repairs on bridge over Pike Creek, Park avenue, Alexandria. Joel B Benofiel, auditor Madison County.

Baltimore, Md.—September 15, until noon, for bascule span, section 4, of Hanover street bridge. Certified check, $2,500. Wm. L. Marcy, secretary State Roads Commission, 601 Garrett Building.

Canton, Ohio—September 9, until 10 a. m., for bridge at Massillon, to include 600 cubic yards excavation and 1,520 cubic yards concrete, 182,000 pounds reinforcing bars and 523,000 pounds steel work. C. L. Stoner, county clerk.

Carroll, Iowa—September 7, until 2 p. m., for eleven concrete culverts and one steel bridge in Carroll County. Estimated cost of culverts, $9,341; of steel bridge, $4,000. Henry M. Hanssen, county engineer.

Delaware, Ohio—September 10, until noon, for superstructure of Beiber bridge, Liberty Township, consisting of two 82 feet 4½ inches c. to c., pin-connected low truss spans and three plate girder spans 60 feet each, with 16-foot roadway. Certified check, $200. W. V. Aldrich, auditor Delaware County.

Elberton, Ga.—September 28, until noon, for county line steel bridge over Broad River above Moore's Ferry, near Bowman, Ga., consisting of one span 160 feet, one span 120 feet and three spans of 80 feet each. Certified check, $200. James McIntosh, chairman Commissioners Roads and Revenues of Elbert County.

Escanaba, Mich.—September 21, until 10 a. m., for one 343-foot 6-inch I-beam bridge with 16-foot roadway over Escanaba River. Certified check, 5 per cent. of bid. R. P. Mason, Delta County.

Newcastle, N. Y.—September 8, until noon, for concrete and masonry arch bridge at Mill street, Mt. Kisco village. Certified check, 5 per cent. of bid. Nelson Sarles, town superintendent of highways, Newcastle.

Overton, Neb.—Until September 11, for Overton bridge; estimated cost, $45,000. Alternate designs as follows: Concrete girder bridge of 25 to 36-foot spans, 16-foot roadway, with concrete piers and abutments, paving over roadway, and protection work; concrete arch bridge of 16 to 50-foot spans with concrete piers and abutments, 16-foot roadway with earth fill over roadway and protection work. Address county clerk, Lexington, Neb.

Petersburg, Ind.—September 8, until 2 p. m., for two steel bridges in Jefferson Township, two steel bridges in Marion Township, four steel bridges with concrete abutments in Lockhart Township, one steel bridge with concrete abutments in Logan Township, one removal of bridge in Lockhart Township and four steel bridges with concrete abutments in Monroe Township. John D. Gray, auditor Pike County.

Salem, Ind.—September 12, until 1:30 p. m., for four concrete bridges in Washington County. F. S. Munkolt, auditor.

San Diego, Cal.—September 10, until 2 p. m., for reinforced concrete girder bridge of 19-foot 11-inch span across El Horne Creek. Certified check, 5 per cent of bid. Clerk, San Diego County.

CONTRACTS AWARDED.

Baltimore, Md.—To H. P. Converse & Co., Boston, Mass., main structure of Hanover street bridge at $607,897.55.

Charlotte, N. C.—To Virginia Bridge & Iron Co., Roanoke, Va., bridge across Catawba River at Mt. Holly, at $18,172.

Dallas, Tex.—To Hess & Skinner, Dallas, three bridges over Elm Creek fork of Trinity River, at $27,250.

Elmira, N. Y.—To Nicholson, Avery & Andrews, city, repairing of stringers on Madison avenue bridge, at $3.98 a stringer.